

> HEAd'17

Proceedings of the 3rd International Conference on Higher Education Advances



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EDITORIAL



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Preface

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Abstract

The series of HEAd conferences have become a leading forum for researchers and practitioners to exchange ideas, experiences and research results relating to the preparation of students and the organization of higher educational systems. The third edition (HEAd'17) was held in Valencia, Spain during 21-23 June 2017. This preface gives an overview of the aims, objectives and scope of HEAd'17, as well as the main contents of the scientific program and the process followed to select them.

Keywords: *Higher education; innovative materials, educational technology, evaluation and assessment, globalization in education.*

1. Preface to HEAd'17

This volume contains the selected papers and posters of the Third International Conference on Higher Education Advances (HEAd'17), which was held in Valencia, Spain during 21-23 June 2017. This third edition consolidates the series of HEAd conferences as a leading forum for researchers and practitioners to exchange ideas, experiences and research results relating to the preparation of students and the organization of higher educational systems.

The selection of the scientific program was directed by M. Cinta Vincent-Vela, M. José Corbatón Báguena and Jorge García Ivars, who led a team of 182 program committee members representing 46 countries in all five continents. Following the call for papers, the conference received 342 full paper submissions from 51 different countries. All the submitted papers were reviewed by at least two program committee members under a double blind review process. Finally, 108 papers were accepted as full papers for oral presentation during the conference. This represents an overall full paper acceptance rate of 31%, in line with the acceptance rate of the previous editions. This selection ensures a high-quality program which is greatly valued by the research communities. Additionally, 20 submissions were accepted as short papers and 33 as poster communications, all of them receiving high review scores and published by UPV Press in this volume. The program committee chairs congratulate all the authors for having their papers accepted in the proceedings of such a competitive conference.

HEAd'17 also featured three keynote speakers that overviewed important and actual topics: Assoc. Prof. Michelle Morgan (Bournemouth University) talked about postgraduate study – the next academic employability frontier. The talk by Prof. Piet Kommers (Universiteit Utrecht) focused on learning for societal evolution. Finally, Assoc. Prof. Javier Oliver (Universitat Politècnica de València) dealt with the development of the institutional project about the generic student outcomes in the host institution.

The conference was hosted by the Faculty of Business Administration and Management of the Universitat Politècnica de València, which has been recently ranked as the best technical university in Spain by the Academic Ranking of World Universities (ARWU) 2015. Valencia is a city of culture and heritage. It is the third largest city in Spain and its location on the shore of the Mediterranean Sea provides their citizens and visitors with a privileged weather.

The organizing committee would like to thank all of those who made this year's HEAd a great success. Specifically, thanks are indebted to the invited speakers, authors, program committee members, reviewers, session chairs, presenters, sponsors, supporters and all the attendees. Our final words of gratitude must go to the Faculty of Business Administration and Management of the Universitat Politècnica de València for supporting, once again, the HEAd conference, making it possible to become a great event.

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Resigned Indifference: The importance of Cultural Competence Education

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Abstract

This paper presents the findings of a PhD study, which explored how nurses' deal with their main concern when caring for patients from diverse cultural and ethnic backgrounds. Utilising theoretical sampling and the principles of a grounded theory approach, focus groups (n-10) and individual face-to-face interviews (n-30) were conducted with student and qualified nurses, in one region of Ireland. As data were collected, it was simultaneously analysed using constant comparative analysis during open, selective and theoretical coding. Uncertainty was the consistent main concern that emerged for participants in this study. Feelings of ambiguity of how to act were further influenced by a lack of knowledge, an awareness of potential ethnocentric beliefs and the culture of the organisation in which participants learn and work in. Resigned indifference explains how participants in this study dealt with their uncertainty when caring for patients from diverse cultures. It explains how participants adopted a range of disengagement strategies. Instead of doing what they sometimes knew to be right, participants adopted a range of disengagement strategies which were underpinned by a resigned indifference. The culture within the organisation allowed the disengagement strategies and indifference to also go un-noticed. As a result culturally insensitive care went unchallenged, often un-noticed and subsequently unchanged. The discomfort associated with providing culturally insensitive care was eased with shifting the blame to professional preparation or organisational constraints. As a consequence culturally insensitive care is sustained and perpetuated. This paper highlights the need for imaginative learning and teaching approaches that will replace uncertainty with curiosity and resilience, apathy with courage and commitment both at individual and organisational levels.

Keywords: *Cultural Competence Education; Cultural diversity; Cultural Difference; Nursing; Nurse Education*

1. Introduction

There is a wealth of evidence in the literature which suggests that nurses experience a range of challenges when caring for patients from diverse cultural and ethnic backgrounds. However, there is a need to further understand how care is organised in healthcare settings as well as what influences nurses attitudes, practices and behaviour when providing quality care in a culturally appropriate way. There is also a need to explore how the culture of the organisation can help or hinder nurses' ability to provide culturally competent care. Although the current literature highlights the different complexities associated with culture competence, it fails to comprehensively identify the extent of the challenges experienced or explain in any depth how nurses address them in their daily practice. From reviewing the literature, it is evident that it remains unclear how nurses prioritise care needs of patients with different cultures and what influences these priorities. This paper presents some key findings from a PhD study (Markey 2017) which explored how nurses deal with their main concern when caring for patients from diverse cultural and ethnic backgrounds, in an Irish context. Drawing on findings, this paper makes a number of recommendations for cultural competence education in the classroom and practice setting.

2. Background

There is a wealth of international literature highlighting the importance of providing culturally competent care (Campinha-Bacote 2011; Jenks 2011) and more recently culturally competent compassion (Papadopoulos *et al.* 2016). However, global reports of culturally insensitive care continue. Cultural competence education is the most commonly reported initiative recommended within the literature as a means of addressing such issues. This call is not unique to nursing, as there are also increasing calls for effective cultural competence education in the preparation of other professionals (Whiteford and Wright St-Clair 2002; O' Shaughnessy and Tilki 2007). However, there remains a lack of consensus within the literature as to how cultural competence education should be structured and organised. This requires a deeper understanding as to what the daily challenges are for professionals during cross-cultural encounters and what influences their attitudes, behaviours and practices. Although there is a wealth of evidence within the literature describing various approaches to delivering effective cultural competence education, there is a lack of consensus with regards to the most effective approaches. It is striking how little is known about the challenges, problems and pitfalls of cultural competence education. Although this paper answers some of these questions, it raises other questions that require further consideration.

Feeling ill prepared to care for patients of different cultures has been widely reported as a challenge for nurses globally. Studies carried out in Ireland (Lyons *et al.* 2008; Tuohy *et al.*

2008) and more globally (Jirwe *et al.* 2009; Starr and Wallace 2009) all highlight the difficulties nurses face when they feel ill prepared to care for different cultures. In particular these studies highlight how nurses feel unsure of how to act and as a consequence are generally fearful of getting it wrong. However, these studies fail to explore how nurses deal with these issues in their daily practice, suggesting the need for further research in the area. While there is an abundance of literature on cultural competence, there is a lack of empirical studies exploring how nurses learn and develop cultural competence on a daily basis. This study helps to fill this gap in our existing understanding. The contextual background to this study is reported on in Markey *et al.* (2012).

3. Methods

This study adopted the principles of a classic grounded theory approach (Glaser 1992) aiming for emerging data grounded in participants' perspectives and experiences. Reasons for choosing a classic grounded theory approach over other grounded theory approaches are reported in Markey *et al.* (2014). Focusing on the main concern of participants and how they deal with it are key components of classic grounded theory (Glaser 1992). Ethical approval was granted from the University and Region Hospital ethics committees. Anticipating and addressing issues of ethical consideration was fundamental in every step of the research process.

In adopting a subtle realist ontological position, capturing accurately and honestly the views and experiences of participants, remaining non-judgemental, prolonged engagement with data and reflexivity were fundamental during data collection and analysis. Data were collected using focus groups (n-10) and individual face-to-face interviews (n-30) theoretically sampling student and qualified nurses, in one region of Ireland. It became clear that students' development of cultural competence was largely influenced by the qualified nurses on the ward, hence signposting the researcher to invite qualified nurses to participate in this study. As data were collected, it was simultaneously analysed using the classic grounded theory methodological principles of open, selective and theoretical coding. Data analysis began with line-by-line in vivo coding transcripts for patterns of behaviour, where key phrases as used by participants own words were noted (Glaser 1992). The data were coded in every way possible, by asking the following questions; what is actually happening in the data? What is the main concern faced by participants? How do participants deal with their concerns? As codes emerged they were clustered into categories. These categories formed the basis for further selective coding exploring how participants dealt with their main concern in practice. Mulling with data, memoing, mind mapping and renaming codes and categories many times were fundamental processes that assisted the conceptualisation of emerging data. Theoretical coding enabled the relationship

of all the categories to be considered in a clear and distinct way and enabled the weaving back of the fractured data that occurred as a result of open and selective coding. The credibility of this study was evaluated using Glaser's (1998) criterion of fit, relevance, workability and modifiability. This theory fits the phenomenon, has workability in explaining how the main concern of participants is dealt with in daily practice, is modifiable with new data and has relevancy to the participants.

4. Findings

The findings describe the different challenges nurses face and how they dealt with them in their daily practice when caring for patients from diverse cultural and ethnic backgrounds. However, the main concern for participants was uncertainty. A number of factors influence the extent of the uncertainty experienced, such as lack of knowledge, ethnocentricity and the organisational culture. Participants consistently described feelings of uncertainty and as a result were fearful of "doing or saying the wrong thing" during cross-cultural encounters.

"I suppose that you would find it weird at the start and because of that, you are always worried about saying the wrong thing and putting your foot in it. Because you don't have the nitty gritty of the knowledge required" (Student Interview 11)

Participants were critical of the cultural competence preparation received during education and training. Although participants appeared to want further information and cultural knowledge, they made few attempts to find out for themselves. Instead, participants used a range of disengagement strategies as a means of dealing with the uncertainty experienced when caring for patients from diverse cultural and ethnic backgrounds.

5. Disengagement Strategies

Participants described how they used a raft of disengagement strategies as a means of dealing with their uncertainties and getting through the day. These disengagement strategies allowed them to disguise the extent of the uncertainties experienced, whilst enabling them to provide care to patients from diverse cultures. Participants also described hiding their uncertainties and knowledge limitations to patients and their peers as a means of self-protecting. This was often described in the context of carrying out a performance and doing what was seen to be needed to get through the day with as little conflict as possible.

“I do think we do stereotype in our heads...we may not.....act it out. I was thinking it in my head. Now ...I didn't let it affect my care, I put my own views aside.”
(Student Interview 4)

Although nurses did not want to allow their uncertainties and ethnocentricities to affect the care they provided, they did not feel able to deal with these issues appropriately in their daily practice. In taking such an approach, ethnocentric values, stereotypes and prejudices remain unchallenged and unaltered. The following interview extract illuminates the consistent behaviour described by participants, whereby temporary measures were taken to disguise as opposed to challenge ethnocentricities and stereotypes. This demonstrates the dichotomy between what nurses' think at a personal level and what they feel they need to do to survive in clinical practice.

“You have values and beliefs, but you have to leave like your personality and personal views at the door or in your car because you have to act in a certain way. You can collect them again on your way out. It's the only way we can ensure the patient care is not affected” (Student Interview 6)

Participants described how they used a range of avoidance strategies to minimise contact with patients from diverse cultural and ethnic backgrounds as a means of dealing with their uncertainties and fears of causing offense unintentionally. When participants did have contact with patients, they described focussing on the physical aspects of their care only, which was often described as tasks at the detriment of meaningfully engaging during cross-cultural encounters.

“My worry of offending someone is taking over from my ability to care for them.. so often I avoid having contact with them as a precaution.” (Student Interview 13)

The culture of the practice setting where nurses learn and work was described as routinizing care. Data highlights that routine assisted to ease the uncertainty experienced as it provided some guidance to their uncertainties. However, not disputing the value of such guidance, the routine described was often rigid, ethnocentric and task-orientated. Participants described various reasons why they needed to fit in with the organizational culture and keeping to the routine that was accepted, took precedence over providing person centered care. Although keeping to the routine helped ease the discomfort associated with feeling uncertain, it facilitated and allowed the disengagement strategies to go un-noticed.

“If I keep to the routine and do as everyone else is doing then it is less likely to illuminate or highlight the bits I don't know or have a clue about” (Student Interview 19)

However, for others being part of the team required complying with practices and attitudes that they sometimes knew to be incorrect. The need to fit in superseded the need to fulfil moral, professional and legal obligations.

“we want to fit in...we want to kind of...don't want to be labelled as the kind of awkward nurse...or the one who is always challenging or questioning” (Qualified Nurse Interview 7)

As a result of adopting such disengagement strategies, there were various examples of culturally insensitive care provided albeit as a result of thoughtlessness, ignorance and unwitting prejudices, as exemplified by the following informant.

“But it's kind of subconscious....well that is what I think anyway nothing bad is intended” (Student Focus Group 2)

6. Resigned Indifference

Participants consistently articulated that culturally insensitive care was rarely intended; however there was a general failure to take action to improve the care described.

“We know it's wrong but we don't do anything about it.” (Qualified Focus Group 2)

There was also a lack of confidence to question their own or their colleagues' attitudes and practices. The fear of being rejected by their peers or failing clinical assessments took precedence over doing the right thing by their patients. Participants described “not wanting to rock the boat”.

“Students will definitely not question or challenge poor practices as that would mean their competencies would be at risk if you know what I mean” (Student Interview 1)

However there was a sense of resigning to the fact that nothing could be done to improve the situation. This was contextualised into adopting various self-rationalising behaviours as a means of self-protecting and easing the discomfort associated with the implications of their actions or omissions. It was easier to blame the organisation for the failure to provide adequate resources, the lack of education and training received or the unprecedented nature of migration to Ireland. Notwithstanding the real pressures nurses experience working in an increasingly complex and diverse healthcare setting, however sometimes such issues were sometimes used as an excuse for the substandard care described. Instead of exploring ways to improve practices and the care provided, participants became resigned to and accepting of the substandard care given to patients from diverse cultural and ethnic backgrounds.

“It’s not our faults, what they expect to happen if they don’t provide us with the staff or interpreters to help us to communicate appropriately with the patient” (Qualified Nurse Interview 8)

Perhaps more concerning was the acceptance of it being acceptable at just doing an “ok job” and doing enough to get by.

“We treat all our patients the same regardless.... And it’s....I think we are doing an OK job” (Qualified Nurse Interview 6)

7. Conclusion and Discussion

This paper presents an overview of the findings from a grounded theory study that explored how nurses deal with their main concern when caring for patients from diverse cultural and ethnic backgrounds. Although this study explored experiences and views of nurses in one region of Ireland, they may be applicable to other professions and contexts. Uncertainty was the consistent main concern that emerged for participants in this study. A number of factors influence the extent of the uncertainty such as lack of knowledge, ethnocentricity and the culture of the organization in which nurses learn and work. Feelings of uncertainty associated with caring for patients from different cultures have been reported by others (Jirwe *et al* 2009; Hart and Mareno 2014). However, what appears to be missing from this evidence is an explanation of how nurses deal with their uncertainties in practice. There also appears limited evidence explaining what influences nurse attitudes, practices and behaviors when caring for patients from different cultures. This study therefore extends our understanding as it explains how nurses deal with the uncertainty experienced in their daily practice and helps us understand the factors that influence nurses’ attitudes, behaviours and practices during cross-cultural encounters.

Resigned indifference helps explain how and why participants in this study used a range of disengagement strategies when caring for patients from diverse cultural and ethnic backgrounds. It explains how participants reduce the personal discomfort associated with not doing what they sometimes knew to be right, by self-rationalising, justifying their behaviour and shifting the blame for the substandard care described. It explains how nurses self-preserve in times of ambiguity and feel unable to deal appropriately with the daily dilemmas faced in healthcare settings today. Despite participants articulating awareness of the moral, professional and legal responsibilities on nurses to provide quality care, culturally insensitive attitudes and practices were frequently described. However these went unchallenged and subsequently unchanged, raising further questions as to why such approaches to care go unnoticed and remain unchallenged both in the classroom and practice setting. The findings also raise questions as to why nurses feel it acceptable to

provide sub standard care to patients from different cultures and why they choose to do sometimes what they know to be incorrect. Although such reports are not unique to caring for diverse cultures (Francis Report 2012), the findings highlight the need for nurses to stop seeing cultural aspects of care as separate. While acknowledging the individual contexts and the constraints experienced, the ease at doing enough to get by, not rocking the boat and shifting the blame are significant findings that warrant consideration. Although the findings do not imply that participants were weak willed and unable to think for themselves, the culture of the organisation is one that does not encourage or support assertiveness or the challenging of attitudes and practices. It was easier to comply with accepted practices than to risk being rejected or suffer the consequences of challenging those in authority. Therefore, this study emphasises the need to pay careful attention to how cultural competence is taught, learnt and most importantly applied in practice, rather than narrowly considering curriculum content in isolation.

The findings highlight the need to re-shape the core values underpinning curriculum design and development, to ensure a continuous commitment to, and reflection upon personal and professional attitudes, behaviours and practices. Taking responsibility for learning and development must replace the ease at shifting the blame and self-rationalising behaviour. Opportunities to explore values underpinning culturally sensitive care demand rethinking educational philosophies and learning and teaching methodologies both in the classroom and during clinical placements. This does not necessarily require major structural changes but instead requires a shift in thinking. Developing independent and enquiry based learning skills is essential in replacing the uncertainty with curiosity. The findings emphasise the need to help nurses rehearse the skills of questioning, clarifying and challenging when something is not right. They need to understand ethical, legal and professional imperatives and develop courage to challenge ethnocentricity and individual and collective indifference. The challenge for nurse educators is to find the balance between developing knowledgeable doers and emotionally intelligent practitioners that have a greater self-awareness of individual and organizational attitudes that may hinder culturally sensitive care.

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Designing a New Video Game App as an aid for Introduction to Programming classes that use C Programming Language

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Abstract

This paper describes the use and development of a mobile application as an aid for an introduction to programming class in C, for first year engineering students. One of the biggest problems in teaching programming, and in particular in C is the concept of memory allocation and pointers. To help visualizing these concepts we developed an application in the form of a video game that works on both Android and iOS devices. The paper is inspired Digital Game Based Learning (DGBL) pedagogical theory, studying the kind of learning that happens when playing computer and video games, how to use this medium as a tool for learning, and how to design games for learning. Research has shown benefits in using mobile applications to better engage students and help them learn at their own pace and level. We did some preliminary performance testing on students from two different groups. One group of computer engineering students and another one of non-engineering majors, both groups learning to program, with no previous knowledge of programming, to evaluate the benefits of the application. The results of this test show that there is an improvement in the students understanding in C, and we also noted a very positive attitude of students toward using something as familiar to them as mobile phones to help them understand the material.

Keywords: *Comuter Education, Educational Video Games, Android, C programming;*

1. Introduction

Research has shown benefits in using mobile applications to better engage students and help them learn at their own pace and level. The goal of the project is to integrate tablets and mobile technologies into computer engineering classrooms. The challenge is to maintain the curriculum -what is being learned- while enhancing the learning experience, active participation, prompt feedback and challenging but achievable goals. This paper explores how tablets can be successfully integrated to create a highly innovative, state of the art environment for teaching programming to engineering students.

Teaching C as the first programming language is a challenge. To the usual difficulties of learning programming for the first time (requiring a slightly different way of thinking) we need to add that C is one of the most difficult programming languages to learn, requiring the mastery of several new and unique to C concepts and has a slow learning curve, meaning that before writing the first program students have to learn and understand several concepts (types of variables, functions, memory allocation of variables , etc) plus the syntax. The problem is that if students don't learn these concepts first, than they will struggle for the rest of the course, increasing frustration and drop off. To help with this stage we have developed an application for mobile devices that will aid in the visualization of memory allocation in C/C++, and will help to explain C concepts giving students the possibility of practicing over and over until they master this principles, and at the same time provide instant feedback to the class instructor allowing for extra homework and recommendations to individual students.

Previous work, Belloc(2009) studies the incorporation of tabletPC on an introductory year in computer engineering class using already available technology to make class presentations for a digital logic/computer architecture class more engaging. But tabletPC are a much smaller market now than mobile phone and tablets, and Classroom Presenter is not available yet for Android or iOS. Liang (2011) Studied the use of tablets on a k12 environment and conclude, that introducing new technologies without support for training and software has no real advantage. Callaghan (2013), Jones (2011) and Collier (2011) Use video games to help teach electrical engineering, finance, and mechanical engineering concepts respectively, showing all of them really promising results.

We decided to create our own application to teach C programming for the following reasons:

1. Current classes are generally very static, based on slides and/or handwritten notes on the board.
2. Students cannot interact with slides. Example: Change values of variables, Increase/decrease loop variables, Assign different addresses to pointers, etc

3. Instructors don't get immediate feedback from students about their understanding of the lecture.
4. Visualizing concepts and being able to touch/design memory help students understand C/C++.
5. General acceptance in the educational community that using video games and mobile devices help students to remain engaged in class.

We decided to implement an application for mobile devices for the following reasons:

1. One of the most important differences between using a mobile device compared vs. a desktop computer, from the classroom point of view, is that users are "able to touch" the screen and move things around.
2. Mobile devices are ubiquitous, almost all students have a smart phone or a tablet. Allowing students to practice anywhere.
3. Mobile devices are easy to bring to class and setup if needed.

The main contribution of this paper is the development of a mobile application to help in teaching programming. To the best of the author's knowledge there is no other application other than tutorials out there on the market that performs the same task as the one presented in this article. The aim is to reinforce programming concepts not to substitute a compiler. To really learn programming students still need to "program", the application will only be used at the initial learning stage.

The article is organized as follows. Section 2 gives the description and overview of previous work, section 3 describes the application in detail, section 4 presents the results of using the application, and section 4 presents the conclusions.

2. Description

A typical introduction to programming class consists on the following topics:

Table 1. Main Programming Concepts.

Variable
Variables declaration
Repetition Statements (for loops)
Functions
Arrays
Strings
Recursion/Tail Recursion
Pointers
Pass by Reference

For difficult concepts like pointers we recommend students to watch videos . Videos can be played again and again until the concept is understood. Several video options were given and after a poll the preferred one was Buckland(2008) a 55 minute video with exhaustive examples. We did get also good feedback from students about the web, Sims(2014), for their online compiler although right now can only be used to program in JavaScript and Python. Therefore we decided to create an application combining in one place the three main principles that are consistently liked by students:

- 1.Ability to watch videos about programming concepts that are deep and present extensive examples.
- 2.Possibility of having code on the screen that can be easily changed and visualize the effect of the change.
3. Having the above points (1, and 2) in a mobile device so students can play with concepts at their convenience and is also easy to carry around.

To incorporate the previous elements the application contains a screen for each one of the elements on table I, this elements are displayed on the main application screen. Each screen is customized for the specific concept, but there are some common elements to all of them.

In part A we describe the common components. Part B describes the peculiarities of each screen.

2.1. Common Screen Elements.

Each one of the screens has three buttons (Fig. 1):

2.1.1 Video

Currently the video button takes the student to a YouTube video. In the future we plan to tape our own videos, we are still undecided if we should tape the professor or actually students.

2.1.2 Slides

This option allows student to download and view class slides related to the topic directly on their device.

2.1.3 Quiz

Each topic has 10 quiz questions; students can retake the quiz as many times as they want although there is a 10 second mandatory delay between submitted answers. If the student answers all the questions correctly a checkmark appears next to the topic name on main screen.

The questions for the quizzes are stored on a database; the database is stored on the cloud using Google App Engine this way the instructor can add/delete questions and the upgrade will automatically show on the students devices without the need to upgrade/reload the application. This option also allows the instructor to personalize the quiz to students by assigning specific or extra questions.

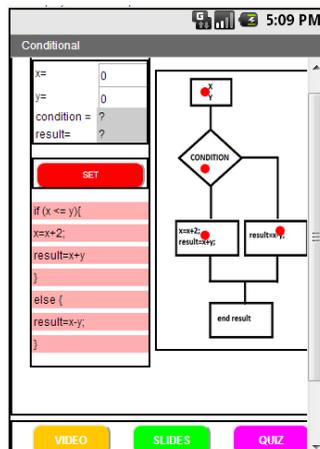


Figure 1. Sample Screen.

3. Results

Before deploying the application on a full university class we did perform testing in a small and controlled sample of students. The students that used the application got, on average 10% higher score on the quiz for memory allocation and showed on average more interest in learning more C than students with just lecture slides and no mobile application. The test administered to students was based on questions for pointers used on previous class exams.

Students that knew already how to program in other programming language did not get too much value from the application except for the pointer screens, but this is expected since the application was just mean to be used on the initial stages of learning how to program.

Based on the positive feedback we are planing in using the application on the first three weeks of the “Introduction to programming” class.

4. Conclusion

The overall experience of using tablets on an introductory programming class has been positive. If the users are beginners they do really enjoy the idea of the tablet as an aid to explain concepts. They still find some of the concepts difficult to understand but they still prefer expending time using the application just reading more examples from a book. But once the students achieve a certain level of expertise they find the application “funny” or “cute” but not very useful. So this application should be used for what it is, for teaching C to people that are beginners programmers. Another important point is that the tool should not be consider as a substitute for a C compiler , the tool is just meant to teach concepts and should always be complemented with programming assignments that will be of course implemented using a text editor/compiler environment.

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Impact of students' performance in the continuous assessment methodology through Moodle on the final exam

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Abstract

This paper looks into the different evolution of students' online questionnaire performance and its impact on the final examination mark. This innovative technique has been used in a group of an introductory financial accounting course with 8 online questionnaires (one per unit) in the Moodle platform. Using cluster analysis, we identify different groups of performance evolution. The evidence obtained suggests that in one of this groups a favourable test performance evolution may lead to overconfidence with the subsequent negative effect on the final examination mark. Future research with more variables and bigger samples will help to identify this student profile with a view to prevent this undesired negative effect of this teaching technique.

Keywords: Moodle; accounting; online questionnaires.

1. Introduction

In the new European Higher Education Area, the educational model must be student-centered (European Ministers of Education, 1999). Therefore, Information and Communication Technologies (ICTs) are very useful in the teaching-learning process (UNESCO, 2008) and there have been numerous experiences of application in different subjects with very positive overall results (García-Benau & Zorio-Grima, 2012; Swan, 2004).

Specifically, in the area of business administration and management, a positive experience on the use of the Moodle platform has recently been analysed (Escobar-Rodriguez & Monge-Lozano, 2012). In this sense, some authors point out the interest of formative evaluation, which has also been evidenced in the accounting field (Einig, 2013).

Our work contributes to the literature in the sense that it identifies different types of students according to their performance evolution in the online tests and how some of these behaviors can be identified as generating over-confidence towards the final exam.

After this brief introduction that states the research objective, section 2 presents the teaching experience, the sample and the methodology used. Section 3 analyzes the results obtained. Finally, the main conclusions are presented.

2. Materials and Method

2.1. Teaching experience

The introduction of the Moodle platform as a teaching and evaluation tool has been implemented in a Financial Accounting course in the year 2015/2016. This subject is taken by first-year students of the Degree in Business Administration and Management of XXXX University. The evaluation of the subject is based on a final exam (80% of the final mark in the subject) and a continuous assessment methodology (remaining 20%) which includes a practical exercise test in the classroom (10% final grade) and eight online questionnaires (one per unit) through Moodle (10%).

In the academic year 2015/2016, the following final grades were obtained for the subject: 26.42% of the students made a no-show, 33.96% failed the subject (final grade <5), 26.42% had passed (5th final grade <7) and 13.21% obtained a grade of good ($7 \leq \text{final mark} < 9$). No student in this group got the highest grade, i.e. excellent ($9 \leq \text{final mark} \leq 10$). Note that the Spanish system has a grading system ranging from 0-10 points, requiring at least 5 points to pass the course.

The syllabus consists of 9 units. 8 units have been evaluated through online self-corrective questionnaires in the Moodle platform, combining multiple-choice and true/false questions.

2.2. Description of the sample

The group of students in this course includes 53 students, 32% of which are women and 68% are men. 81% of the students are between 18-24 years old, 9.43% between 25-29, and the rest are over 30 years old. The 73.6% is the first time they take the subject, 15.1% re-take it for the second time and 11.3% of the students are taking it at least for the 3rd time.

During the 2015/2016 academic year, 94.12% of women chose to follow the continuous assessment system (16/17) compared to 83.33% of men (30/36). Of the total of 46 students who followed the continuous assessment method, only 39 showed up in the final exam (84.7%).

2.3. Variables and Data Analysis

We use the Cluster Analysis in its hierarchical modality, whose main purpose is to group objects based on the characteristics they possess, trying to maximize the homogeneity of the objects within the clusters while at the same time maximizing the heterogeneity between the aggregates (Hair *et al.*, 1999).

Also, Multiple Correspondence Analysis is implemented, as it is a procedure to summarize the information contained in a contingency table through an objective procedure of assigning numerical values to qualitative variables (Peña, 2002).

For the analysis of multiple correspondences, the average grade of the online tests and the grade of the final exam have been categorized into a variable with 4 categories (failed, pass, good, excellent). The equivalences are Failed $X < 5$ (variable = 1), Pass $5 \leq x < 7$ (variable = 2), Good $7 \leq x < 9$ (variable = 3), Excellent $x \geq 9$ (variable = 4).

3. Results

3.1. Pearson's correlation analysis

A Pearson correlation analysis is performed considering as variables the final exam grade and the grade of each of the questionnaires. There was no significant correlation between the grade obtained in the final exam and the grade obtained in any of the 8 questionnaires.

For the case of the tests, there is significant and positive correlation between the test of the units 3 and 4 ($r=0.315$, $\text{sig}=0.033$), and for the units 6 and 7 ($r=0.339$, $\text{sig}=0.047$). Note that these tests refer to consecutive but not specifically related thematic units: "accounting cycle" (unit 3) and "Inventories" (unit 4), "Non-financial fixed assets" (unit 6) and "Other financial assets and liabilities" (unit 7). This may suggest that the variables that condition the results obtained in the test are not only related to contents but also to other variables such as the chronology of the course, the specific academic calendar of that course, the evolution of student motivation along the course, etc.

3.2. Student profiles in continuous assessment

A hierarchical cluster analysis is performed on the students performance, considering as classification variables the different grades obtained in each one of the questionnaires.

The Ward method is chosen to minimize the differences within the cluster and avoid problems with the allocation chaining. Among the different alternatives, in terms of the measure of similarity between objects, the square Euclidean distance has been chosen, since the variables are measured on a common scale (0 to 10). As mentioned above, there are no problems of multicollinearity in our sample.

After studying multiple solutions, a solution with three clusters has been chosen.

Table 1. Number of cases in the solution.

Cluster	Cases	%
1	12	48%
2	4	16%
3	9	36%
Valid	25	
Lost	21	

Table 2. Cluster composition.

Variable	Cluster 1	Cluster 2	Cluster 3
T1	7,22	8,19	7,04
T2	7,61	7,24	8,22
T3	6,73	6,81	6,58
T4	7,21	N.P.	8,06
T5	7,52	7,25	7,87
T6	6,75	7,00	7,41
T7	7,17	6,50	8,11
T8	5,25	6,33	9,48

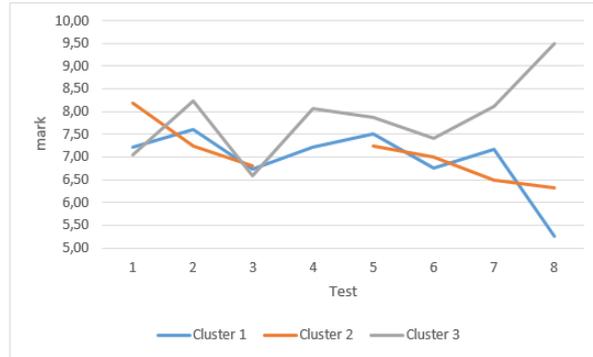


Figure 1. Evolution of the average mark per cluster.

Figure 1 shows that students in Cluster 1 and 2 have followed a decreasing trend in their results of the continuous assessment questionnaires, compared to students in cluster 3 that are characterized by an increasing trend in their results of the questionnaires. The main difference between clusters 1 and 2 is that cluster 2 maintains a nearly constant decreasing trend and cluster 1 has a greater variability in the average test results.

Likewise, for a more visual interpretation of the different clusters, the evaluation of the similarities between the different profiles of students (according to their results in the tests) and the categorization of the average grade obtained in the questionnaires has been performed with a multiple correspondence analysis. The results are presented on a perceptual map (Figure 2). The blue circle shows the 3 categories of average marks in the tests (1, failed, 2, pass, 3 good) and the green circle represents the profile student cluster (1, 2 and 3, illustrated in Tables 1 and 2 as well as in Figure 1).

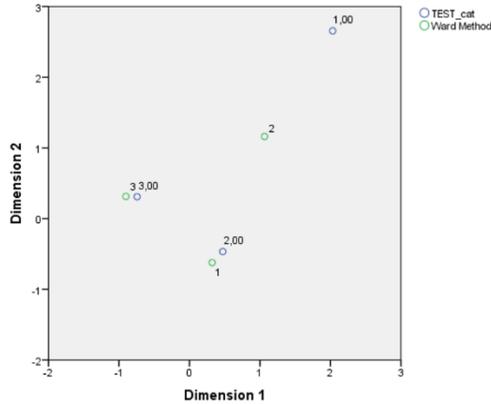


Figure 2. Perceptual map of the multiple correspondence analysis for the categorical variable Test and the result of the cluster analysis.

According to figure 2, and as expected, those students who obtain an average mark of good in the tests are mainly those in cluster 3, whereas those who do not take test 4 (cluster 2) are the closest to obtaining an average grade of test of failed, and those in cluster 1 are those that obtain an average grade of pass.

3.3. Impact of students' performance in the continuous assessment through Moodle on the final exam mark

In this section, we look into the similarities between the different profiles of students (according to their result in the questionnaires) and their mark in the final exam through a multiple correspondence analysis. The perceptual map (figure 3) will help us identify the profile of students who achieve better results in the final exam.

The number of dimensions is selected based on the desired level of total explanation of the variation and the increase of explanation when adding an extra dimension. It is recommended to include in the analysis those dimensions with inertia greater than 0.2, always taking into account that a three-dimensional representation, or smaller, are valuable for an easier interpretation.

Thus, a two-dimensional solution is the most suitable for further analysis in terms of explanation and interpretation.

Table 3. Dimensions and inertias.

Dimension	Eigenvalue	Inertia	Proportion of inertia	
				Cumulated
1	0.249	0.062	0.789	0.789
2	0.129	0.017	0.211	1.000
Total		0.078	1.000	1.000

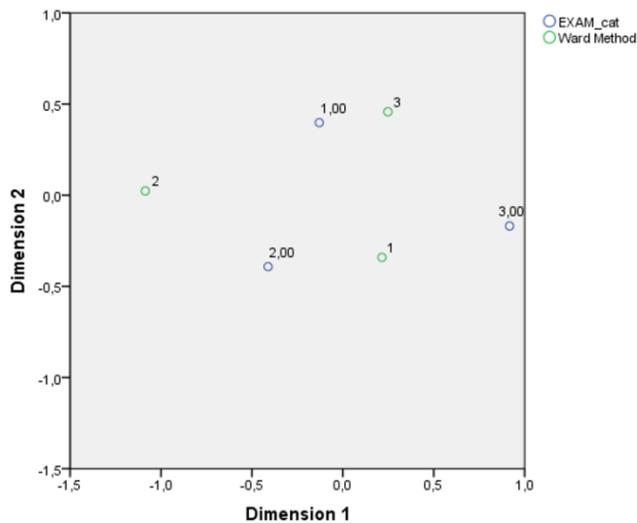


Figure 3. Perceptual map of the multiple correspondence analysis for the categorical variable Final exam and the result of the cluster analysis (student profile).

Contrary to what might be considered as an initial hypothesis, the perceptual map shows that there is a relationship between those students who belong to cluster 3 and category 1 of the final exam mark (failed). Smolin & Butakov (2014) look into this paradox, i.e. the inconsistency between in-class performance and the performance in the final exam. On the other hand, there is also a certain similarity between the students in cluster 1 and category 2 of the final exam result (pass).

Category 3 of the exam mark (good) is not specifically related to any student profile.

This result could indicate that there is an inverse relationship between the trend in the results obtained in the continuous assessment by a student and the probability of passing the final exam.

The findings of our study suggest some very interesting questions for future research, as follows. Could the relationship identified with failure in the final exam be attributed to certain emotional factors such as overconfidence? Does the tendency for a worsening of the continuous assessment mark encourage the student to make a greater study effort for the final exam?

4. Conclusions

In the context of incorporating the ICTs to the formative evaluation of the students, it seems extremely relevant to evaluate if an improvement on students' performance is really and efficiently achieved. The literature describes the different learning styles of the students (Escobar-Rodriguez & Monge-Lozano, 2012) and how different methodologies can be useful to respond to that variety. However, in accounting, there is no extant research on the existence of different patterns of knowledge level evolution, nor on the impact of these patterns on a final exam. Some studies, however, point out the possibility that in certain contexts overconfidence can arise depending on certain variables - such as the previous domain of technology or gender (Gunn and McSporran, 2003). Therefore, our findings suggest new avenues for research on the results of these new teaching methodologies using larger samples and more variables that may allow to identify the characteristics of the students with this profile, in order to try to avoid these undesired consequences of the instrument.

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Strategies to assess generic skills for different types of students

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Abstract

The Universitat Politècnica de València (UPV) has synthesized a profile to be acquired by all the students based on 13 generic skills. For its assessment, the UPV has also developed a rubric for every skill depending on the level of the course. In this research, we develop an educational innovation for validating the rubrics for 3 of the 13 generic skills specified by the UPV. The chosen skills are: “Ability to think practically and apply knowledge in practical situations”, “Innovation, creativity and entrepreneurship ability” and “Teamwork and leadership ability”.

To do this, we develop the same methodology in two groups (Morning/English) of the same course (Marketing Research of the Degree of Business Administration and Management of the Faculty of Business Administration and Management at the UPV) with significantly different student profiles. The assessment results of the skills reveal that there are no significant differences between groups. In conclusion, we could say that the rubrics developed by the UPV are adequate to assess all types of students: Erasmus or non-erasmus, working or having worked in the last 2 years or without work experience, and regardless of their satisfaction with the course.

Keywords: *Generic skills; achievement; rubric; validation; profile; competency-based learning.*

1. Introduction

The Universitat Politècnica de València (UPV), taking into account the most important standards and guidelines as well as national and international scientific literature, has listed 13 generic skills. These skills synthesize a profile that has to be acquired by all the students at the UPV. For its assessment, the UPV has also developed a rubric for every skill depending on the level of the course (Universitat Politècnica de València, 2016).

Competency-based learning supposes a completely different way of curricular organization and teaching and learning methods (Lasnier, 2000). The challenge we face now is how to develop assessment strategies for these 13 generic skills according to Bologna Process (European Ministers Responsible for Higher Education, 1999). These strategies should be focused on the students for a better learning (Biggs and Tang, 2011).

In this research, we develop an educational innovation for validating the rubrics for 3 of the 13 generic skills specified by the UPV. The chosen skills are: “Ability to think practically and apply knowledge in practical situations”, “Innovation, creativity and entrepreneurship ability” and “Teamwork and leadership ability”. The specific objectives of the research are: (i) measure the achievement of every generic skill considered, and (ii) check for significant differences in the achievement of students depending on their profile.

2. Theoretical framework

Assessment is a necessary byproduct of the current emphasis in higher education on accountability and learning outcomes. Assessment activities can identify learning outcomes for student success and improvement over time in student learning (Dunn, 2002). Multiple approaches are needed in the assessment of learning, many of which require the use of a rubric (Dunbar, Brooks and Kubicka-Miller, 2006).

Rubrics are documents that articulate the expectations for an assignment, or a set of assignments, by listing the assessment criteria and by describing levels of quality in relation to each of these criteria (Reddy and Andrade, 2010). In a student-centered approach, the rubric could be shared with the students in order to support student learning. The main reason for this potential lies in the fact that rubrics make expectations and criteria explicit, which also facilitates feedback and self-assessment (Jonsson and Svingby, 2007). In the case of the UPV, both the 13 generic skills and the corresponding rubrics are published on their own website for the students' knowledge.

However, there are a number of factors identified that may moderate the effects of using rubrics formatively, as well as factors that need further investigation. Panadero and Jonsson

(2013) point out *Gender* and *Educational level* among others. In this research, we consider *Gender* and other variables in order to define the students' profile in higher education.

3. Methodology

The course where we develop this educational innovation is "Marketing Research". It is taught in the first semester of the third year of the Degree of Business Administration and Management of the Faculty of Business Administration and Management at the UPV. The educational innovation is carried out in the Morning Group and in the English Group.

First of all, students were divided into groups of 2-4 people. In total, 32 groups of students were formed: 20 in the Morning Group and 12 in the English Group. Once organized, they were asked to propose a new product / service for a supermarket. To do this, they had to elaborate a concept test in order to determine the suitability of the new product / service. They have worked on this concept test both in theory classes (to sketch and generate ideas) and in lab sessions (for the completion of the questionnaire and analysis of the answers obtained from it). Based on their work, they have drafted one report per group.

This group report is the one we are going to use for the assessment of "Ability to think practically and apply knowledge in practical situations" and "Innovation, creativity and entrepreneurship ability". It is evaluated by the lecturer. Instead, to evaluate "Teamwork and leadership ability", we use self-assessment and co-evaluation among members of the same group. For both the report and the self-assessment and co-evaluation, we use the rubrics developed by the UPV. Following the institutional project, 4 different categories are established: A. Excellent / exemplary; B. Good / adequate; C. In development; D. Not reached. In order to facilitate an average per group, these 4 categories have been translated into numbers according to the following scale: A = 4, B = 3, C = 2 and D = 1.

4. Results

4.1. Group profile

In the total sample, there are 110 students: 65 in the Morning Group and 45 in the English Group. To determine the profile of every group, a cross-tabulation of frequencies between the data of the Groups with the different variables considered (*Gender, Erasmus, Working and Satisfaction with the course*) was conducted. As a statistical test, Pearson's Chi-square test (χ^2) was performed (Santesmases, 2009). From the results obtained, it can be observed that there are not significant differences between the Morning Group and the English Group regarding the *Gender* variable (Table 1). However, there are significant differences with respect to the other variables.

Table 1. Cross-tabulation of frequencies between Group and Gender.

Gender	Morning Group		English Group	
	Frequency	%	Frequency	%
Man	28	43.08	22	48.89
Woman	37	56.92	23	51.11
TOTAL	65	100.00	45	100.00

χ^2 with 1 degree of freedom = 0.3623 (p = 0.5472). Source: Authors.

As for the *Erasmus* variable (p <1%), 44.44% of the students in the English Group are Erasmus Exchange students and in the Morning Group only 3.13% (Table 2). In the English Group, 71.11% are working or have worked in the last 2 years, while in the Morning Group this percentage drops to 41.38% (p <1%) (Table 3). Finally, in the Morning Group, students who consider the course interesting or very interesting are 88.33%, rising to 95.56% in the English Group (p <5%) (Table 4).

Table 2. Cross-tabulation of frequencies between Group and Erasmus.

Erasmus Students	Morning Group		English Group	
	Frequency	%	Frequency	%
Erasmus	2	3.13	20	44.44
Not Erasmus	62	96.88	25	55.56
TOTAL	64	100.00	45	100.00

χ^2 with 1 degree of freedom = 28.0018 (p = 0.0000). Source: Authors.

Table 3. Cross-tabulation of frequencies between Group and Working.

Working or having worked	Morning Group		English Group	
	Frequency	%	Frequency	%
Working	24	41.38	32	71.11
Not working	34	58.62	13	28.89
TOTAL	58	100.00	45	100.00

χ^2 with 1 degree of freedom = 9.0289 (p = 0.0027). Source: Authors.

Table 4. Cross-tabulation of frequencies between Group and Satisfaction with the course.

Satisfaction with the course	Morning Group		English Group	
	Frequency	%	Frequency	%
Very uninteresting	1	1.67	0	0.00
Uninteresting	1	1.67	1	2.22
Indifferent	5	8.33	1	2.22
Interesting	44	73.33	25	55.56
Very interesting	9	15.00	18	40.00
TOTAL	60	100.00	45	100.00

χ^2 with 4 degrees of freedom = 9.9589 ($p = 0.0411$). Source: Authors.

In short, we can state that, despite having analyzed a single course, the profiles of the two groups are different in terms of the number of Erasmus Exchange students, the number of students who are working or have worked in the last 2 years and their satisfaction with the course.

4.2. Comparison of skills assessment by group

In order to show the results of the assessment of the 3 generic skills, the average of each of the indicators considered in the rubrics was calculated by Group (Morning / English) and for the total of the sample. To verify if there are significant differences between the results of each group, a cross-tabulation of mean values was performed. As a statistical test, the Snedecor F test was used (Santesmases, 2009).

There are not significant differences by indicator between both groups for the “Ability to think practically and apply knowledge in practical situations” (Table 5). The indicator that has the greatest average in each group and in the total of the sample is “Sets specific targets in relation to the situations that are presented”. In contrast, the indicator that has the lowest average in the total sample and in the English Group is “Evaluates the quality of information available for application”. The Morning Group obtains the lowest average in “Proposes control indicators for monitoring the plan”. The greatest and lowest means are underlined in Table 5.

Table 5. Assessment of “Ability to think practically and apply knowledge in practical situations”.

Indicators of the rubric	Morning Group	English Group	Total Sample	p
Sets specific targets in relation to the situations that are presented	<u>3.40</u>	<u>3.75</u>	<u>3.53</u>	0.5051
Obtains the necessary information to address situations	3.05	3.00	3.03	0.9900
Evaluates the quality of information available for application	2.90	<u>2.42</u>	<u>2.72</u>	0.4237
Draws up a coherent plan to resolve situations that are presented	2.95	2.67	2.84	0.7315
Proposes control indicators for monitoring the plan	<u>2.80</u>	3.25	2.97	0.2120

Source: Authors.

For “Innovation, creativity and entrepreneurship ability” (Table 6), there are not significant differences per indicator between both groups except for “Controls Results” ($p < 5\%$). In this case, the Morning Group obtains its lowest average (2.55) in this indicator, while the English Group obtains a higher score (3.25). The indicator that has the lowest average in the English Group is “Uses creative strategies and / or techniques to shape ideas and solutions in a formal way”. The total sample obtains its lowest means (2.81) in both cases. On the contrary, the indicator that has the highest average in each group and in the total of the sample is “Identifies opportunities and / or improvement aspects”. The greatest and lowest means are underlined in Table 6, as well as the significant probability at 5%.

Table 6. Assessment of “Innovation, creativity and entrepreneurship ability”.

Indicators of the rubric	Morning Group	English Group	Total Sample	p
Identifies opportunities and / or improvement aspects	<u>3.20</u>	<u>3.67</u>	<u>3.38</u>	0.2415
Provides original ideas and approaches	3.05	3.58	3.25	0.2593
Uses creative strategies and / or techniques to shape ideas and solutions in a formal way	2.90	<u>2.67</u>	<u>2.81</u>	0.7866
Controls results	<u>2.55</u>	3.25	<u>2.81</u>	<u>0.0433</u>

Source: Authors.

There are not significant differences per indicator between the two groups for “Teamwork and leadership ability” (Table 7). The indicator that has the highest average in each group and in the total of the sample is “Participates in the planning of the objectives”, while the indicator with the lowest mean is “Acts to deal with the conflicts of the team”. The greatest and lowest means are underlined in Table 7. It should be pointed out that this generic skill has greater averages (all of them are greater than 3.55) in comparison with the other two skills. This might be due to the self-assessment and co-evaluation conducted by the students.

Table 7. Assessment of “Teamwork and leadership ability”.

Indicators of the rubric	Morning Group	English Group	Total Sample	p
Participates in the planning of the objectives	<u>3.77</u>	<u>3.71</u>	<u>3.74</u>	0.8465
Acts to deal with the conflicts of the team	<u>3.68</u>	<u>3.58</u>	<u>3.64</u>	0.6399
He/she has committed to the realization of the collective tasks	3.71	3.67	3.69	0.9347

Source: Authors.

5. Conclusions

The educational innovation is developed in the Morning and English Groups of the course “Marketing Research” of the Degree of Business Administration and Management of the Faculty of Business Administration and Management at the UPV. The total sample analyzed is 110 students (65 in the Morning Group and 45 in the English Group). In spite of having analyzed a single course, the profiles of the two groups are significantly different in terms of the number of Erasmus Exchange students, the number of students who are working or have worked in the last 2 years and their satisfaction with the course.

Nevertheless, despite this difference in profile, no significant differences are found in the assessment of the 3 generic skills. Each of the indicators considered in the rubrics has been evaluated and no significant differences in the mean value of each group have been obtained. We only have one significant difference in the indicator “Controls results” of “Innovation, creativity and entrepreneurship ability”.

As there are no significant differences between the Morning Group and the English Group in the assessment of skills, we could say that the rubrics developed by the UPV are

adequate to evaluate all types of students: Erasmus or non-erasmus, working or having worked in the last 2 years or without work experience, and regardless of their satisfaction with the course.

Having evaluated each generic skill with a different methodology, we observe how students are more generous in self-evaluation and in evaluating their peers in the “Teamwork and leadership ability”. On the contrary, the lecturers of the course are more rigorous when evaluating “Ability to think practically and apply knowledge in practical situations” and “Innovation, creativity and entrepreneurship ability” from the report elaborated by the group.

As future lines of research, this educational innovation could be conducted in different degrees of the UPV to validate these rubrics from a multidisciplinary approach.

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Outcome assessment of the online English learning and management system: A project on educational technology application to English learning in Taiwanese polytechnic higher education

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Abstract

This paper presents the result of a three-year action research plan involving the innovative application of “LiveDVD”, a web-based English learning system loaded with VODs and embedded into the English learning program of a polytechnic university in Taiwan. Over the implementation period, the LiveDVD action plan essentially involves use requirement on students along with creation of learning and assessment materials for the target VODs and outcome management. Outcome assessment indicators include (1) the association between use activeness of LiveDVD and pass status of English proficiency certificates and (2) the causal relations between LiveDVD-related variables and English learning outcome. A survey questionnaire on LiveDVD and the management platform were employed to collect relevant data. The chi-squared test of group independence and an SEM-based path analysis were performed to address the outcome indicators respectively. The findings of the project include: (1) use of LiveDVD is positively and significantly associated with the pass status of English proficiency certificates and, (2) use motivation has direct effect on English proficiency and create the significant mediation effect on English proficiency certificates. This project yields significant implications especially for vocational higher education in Taiwan in the innovative application of educational technology to English education coupled with an effective outcome management model.

Keywords: *technology enhanced language learning, computer aided language learning, SEM-based path analysis, LiveDVD.*

1. Introduction

Vocational higher education has hardly been the government's top priority, and schools in this system have long been criticized by policymakers and EFL teachers for having undesirable English learning standards. In a formal school English learning setting, two critical but long neglected elements conducive to successful English education at polytechnic universities are, arguably, an effective learning tool or program and outcome management. Lack of learning motivation of students, especially those of vocational and technological universities, has long been claimed to cause undesirable outcomes of English education in Taiwan. In a technology-friendly age, language learning enhanced and aided by technology has been a vital issue in ESL/EFL teaching and learning. How to best utilize education technology to enhance English learning becomes particularly significant in terms of increasing, on a large scale, the learning motivation of low achievers in the Taiwanese vocational higher education. Teaching approaches geared towards initiating self-directed learning via technology-mediated support with a view to enhancing learning motivation have hence been gaining ascendancy in English learning settings across different educational levels in Taiwan. The purpose of this paper is therefore to document the process, method, management and result of embedding the technology enhanced learning aid to the English education of Southern Taiwan University of Science and Technology (STUST) as a long-term action research project.

1.1 LiveDVD Online Film-based English Learning and Management System

LiveDVD is characterized by a series of learner-friendly and helpful features along with a powerful management module. The system platform can accommodate 600 concurrent users to access as many as around two hundred VODs on the LiveDVD server. Students connect to the system platform to watch the uploaded films, learning English by using a series of functions, including (1) display of multi-mode film subtitles (e.g. English-Chinese subtitles), (2) key word search and playback of movie clips, (3) the on-line dictionary, (4) collection of movie lines and words, (5) vocabulary coverage based on the TOEIC word lists, among others.

The LiveDVD system comes with a management platform, or module, known as WEBMEN, specifically for school administrators and teachers to collect and analyze data of students' learning by LiveDVD. The main function of the platform is to establish students' learning profiles and track their learning hours, movies watched, practice tests completed, and specific features practiced. All types of learning data can be exported for statistical analyses and assessment for administrative, teaching and research purposes.

The strengths of LiveDVD essentially relate to employing multimedia to intrigue learners and engage them in learning English. Multimedia provides variety and excitement to a computer-supported teaching and learning environment, adapting instruction to diverse learning preferences of students (Zaidel & Luo, 2010). Multimedia materials such as DVDs and VODs as effective self-directed learning aids enhance students' comprehension and memory, increase their motivation, and promote their concentration on the content in a near natural environment (Astleitner & Wiesner, 2004; Deimann & Keller, 2006; Guariento & Morley, 2001). Multimedia has been widely investigated for language learning and teaching (Astleitner & Wiesner, 2004; Mayer, 1997; Synder, 1988; Weyers, 1999). Several studies have found that a combination of audio and visual media aids and sequential or simultaneous use of a variety of media formats in a given presentation or self-study program can facilitate language learning (Edasawa, Takeuchi & Nishizaki, 1990). As noted by Willberschied & Berman (2004), learners achieve a better understanding of a given combination of audio with texts, which is dynamic, immediate and accessible, and helps learners gain broad access to oral communications audiovisually. Moreover, interactive video or audio materials have changed students from passive observers to active participants (Chavez, 1998; Goh, 2002). Technology aided teaching featured by both authenticity and uniqueness is capable of creating sufficient information to provide learners maximum linguistic and cultural input, and increasing learners' motivation (Stempleski & Arcario, 1992). The different aspects of authenticity created by multimedia technology are facilitating to language learning (Rost, 2002), for they provide rich input for the EFL learning environment by integrating phonetic, syntactic, semantic, pragmatic, and socio-cultural features.

1.2 LiveDVD Learning Action Plan

The LiveDVD action plan involves implementation of the learning regulations embedded into the required English course and creation of extended learning materials for selected VOD films. As far as learning regulations are concerned, a minimum learning-hour-per-semester requirement is set for every participant of the required English course to ensure that students use LiveDVD as expected by the school. Students are also required to view at least one VOD film on LiveDVD every semester, and are tested at the semester end on the designated film as an estimate of their learning achievement of the film. As a graduation requirement, students must also pass an English ability threshold indicated by a variety of English proficiency certificates (e.g. TOEIC, BULATS, etc.) recognized by the university. Additional learning materials are also created for 20 VODs (e.g. *A Christmas Carol*, *Slumdog Millionaire*, etc.) uploaded on the LiveDVD platform. The developed materials include (1) film-based English word glosses, (2) English and Chinese learning guides, and (3) self-assessment materials. The management platform, furthermore, can track the

learning status of students and alert them to catch up with their learning whenever it falls short of expectations.

2. Methodology

To evaluate students' learning outcomes and processes associated with LiveDVD, two indicators are focused: (1) association between usage hours and pass status of English proficiency certificates and (2) relationship among the variables underlying the LiveDVD learning.

For the first outcome indicator, a Chi-squared group independence test was performed using R package v.3.1.0 (R Core Team, 2014) to test the independence of the variables of LiveDVD use level and the certificate pass status as an indication of whether the degree of LiveDVD use is statistically associated with whether students eventually acquire the English proficiency certificates. Two categorical variables are posited, Use Level (5 levels) and Pass Status (2 levels), and a five-by-two contingency table is generated (v. Table 1) for the Chi-square analysis to test the independence of the two variables.

Another outcome indicator is the relationship between the observed variables on LiveDVD (i.e. use motivation, learning features, and learning regulations) and outcome variables (i.e. English proficiency, and pass status of English proficiency certificates) as an indication of the effect of LiveDVD on the English learning. For this purpose, the observed variable and SEM-based path model was put forward, which consists of six exogenous and independent variables, namely, Group, Year, Learning Features (LF), Learning Regulations (LR), Use Motivation (UM), and English Proficiency (EP), and five endogenous and dependent variables, namely, LF, LR, UM, and Certificate Attainment (CA). To test the proposed model, a valid sample from 1739 students was obtained through the administration of the questionnaire QLDVDL with 7-point Likert items, and the OV-based path analysis was conducted using LISREL 9.1 to yield the results.

3. Results

3.1. Chi-squared test of group independence

Table 1 presents a five by two contingency table comprising the two categorical variables. A Pearson's chi-squared test for group independence was performed using R 3.1.0, returning a chi-squared value of 90.110 ($df = 4$) and an extremely small p -value ($p = 2.2e-16$), rejecting the null hypothesis of independence of the two variables, and suggesting that whether the students obtained English proficiency certificates is significantly associated with how actively they use LiveDVD in English learning. Figure 1 reveals furthermore the

interaction between the two variables, indicating the tendency of the ever-increasing passing rate of English proficiency certificates with the increasingly active use of LiveDVD, or when the use of LiveDVD gets more active, the passing rate of English proficiency certificates would get higher and the no-pass rate gets lower.

Table 1. Contingency table on Use Activeness by Certificate Attainment

Certificate Attainment	# of students without certificate	% of students without certificate	# of students with certificate	% of students with certificate	Total student #
Use Activeness					
1/Very Inactive	234	64.64	128	35.36	362
2/Inactive	282	58.26	202	41.74	484
3/Mid-Active	214	49.54	218	50.46	432
4/Active	584	44.58	726	55.42	1310
5/Very Active	210	37.77	346	62.23	556
Total	1524		1620		3144

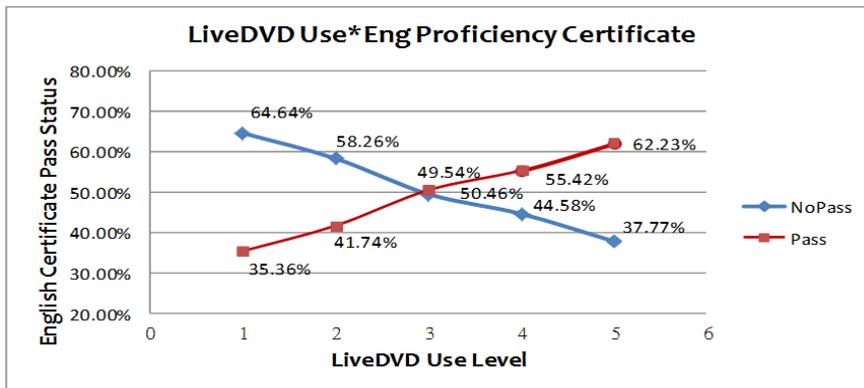


Figure 1. Association between LiveDVD use activeness and English Certificate pass status

3.2. SEM-based path model

The test results of the proposed path model are shown in Table 2, with the model fit statistics found to meet the commonly accepted criteria (Bagozzi and Yi, 1988 ; Hair, Black, Babin, Anderson and Tatham, 2006), indicating that the proposed model is not significantly different from the expected model, and suggesting that the proposed model is fairly fit for the input data. The path coefficients of the path model are presented in Figure

2, in which the solid line indicates a statistical, or statistically significant, relationship, while a dotted line refers to a non-statistical, or statistically non-significant, relationship between two observed variables.

Table 2. Model fit statistics of the proposed path model

Evaluation indicators	χ^2	df	<i>p</i>	χ^2/df	NFI	CFI	RMSEA	RMSR
Evaluation Criteria				< 3	>.09	>.09	<.05	<.05
Model value	1.74	5	.88	.348	.99	1.00	.00	.005

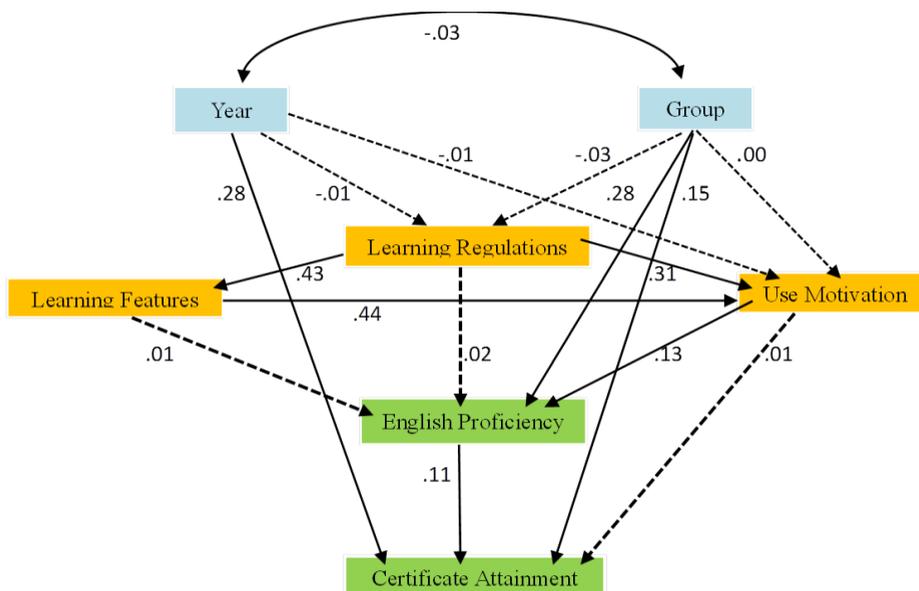


Figure 2. Path coefficients of the proposed model

As shown in Figure 2, Group and Year have a direct effect on Certificate Attainment, and Learning Feature (LF) and Learning Regulation (LR) have a direct effect on Use Motivation (UM). Moreover, LF and LR have an indirect effect on English Proficiency (EP) via UM as a full mediator variable, while UM has an indirect effect on CA via EP as a full mediator variable. To determine the mediation status of UM, a matrix correlation

among LF, LR, UM, EP and CA was performed, and two regressions were conducted using EP as a dependent variable, and UM/LR and UM/LF as predictor variables. With the introduction of Motivation into the path model, the statistical correlations between Motivation and Feature and Proficiency are established, but the statistical correlation originally existing between Feature and Proficiency becomes not statistical, demonstrating that UM functions as a full mediator variable for LF and EP. The same role of a full mediator variable is true of UM in the path model where LR and EP are fully mediated by UM.

4. Conclusion and Implication

This paper presents the result of the action research project featuring the LiveDVD online English learning system embedded into the English education program of STUST aiming to promote students' learning motivation and upgrading their English ability. Central to the project is the LiveDVD action plan embracing learning regulations and learning of supplementary materials. To assess the 3-year learning outcome, analyses were made to understand association of use activeness and pass status of English proficiency certificates, and relationships between LiveDVD-relevant and learning outcome variables.

The activeness of using LiveDVD was found to be statistically associated with the pass status of English proficiency certificates, suggesting that the more actively LiveDVD was used, the more likely students would be able to pass the English proficiency certificate tests. The testing of the proposed SEM-based path model identified Use Motivation as a full mediator variable between Learning Regulations and Learning Features and English Proficiency, indicating not only the direct effect of Use Motivation on English proficiency, but a significant indirect effect of Learning Regulations and Learning Features on English Proficiency, which, in turn, has the full mediation effect on Certificate Attainment. This result has significant implication for the importance of perfecting learning features and improving learning regulations to motivate students to enhance their English ability by using LiveDVD, and ultimately to obtain English proficiency certificates.

This project sets a successful example of applying LiveDVD for English learning and teaching purposes in a vocational higher education context typically characterized by a large student population with overall mid or low English entry ability and learning motivation. The outcome of this project shows that the technology enhanced teaching or learning approach via the learning instrument such as LiveDVD can make a positive change in students' learning motivation and improve their learning outcome. These positive outcomes create avenues for further development on the EFL teaching and research fronts. More significantly, this study engenders a valuable empirical model demonstrating how a better English education can be achieved in vocational higher education through innovative

integration of technology and education and optimal utilization of such integration by, as and for effective management.

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Freshman African engineering student perceptions on academic feedback – A case study from Digital Systems 1

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Abstract

Providing effective and quality feedback to students in higher education has been identified as an integral part of quality teaching by many researchers in the field of education. However, student perceptions vary drastically as to what they perceive academic feedback to really be. Therefore, this paper aims to present freshman engineering student perceptions of academic feedback from an African perspective. The reason for targeting this group is due to their high dropout rate in higher education in South Africa (around 60%). Quantitative data was collected from freshman engineering students enrolled for a module termed Digital Systems 1 at the Central University of Technology in South Africa. A questionnaire was used as the main data collection instrument featuring 21 close ended questions. The results presented in this paper indicate that almost two-thirds (65%) of the respondents believe that a “grade” written on a test script does not constitute academic feedback. The majority of the respondents (76%) expect some kind of academic feedback regarding their work, either in writing or orally from their lecturer. A good majority (86%) of students perceived that getting written comments on their assessments would encourage them to approach the lecturer to seek further clarification. A key recommendation of this study is to find a mechanism or technique of providing constructive feedback to all enrolled students, even in large classes. This needs to be done from the outset of the module in order to reduce the current high dropout rates among freshman engineering students.

Keywords: *constructive feedback; freshman drop-out rates; learning cycle; student perceptions*

1. Introduction

“Education is the most powerful weapon which you can use to change the world” (“Mandela”). These are the famous words of a late president of South Africa (SA), Nelson Mandela. Unfortunately, the call to education has not been taken seriously among many youths in SA. Statistics from studies conducted in tertiary educational institutions show (ECNA, 2015; J swart, 2014; John, 2013) that up to 60% of students dropout in their freshman year. They further state that of the rest that make it into their second year, only 35% graduate in the allotted time of the qualification. Reasons for this dropout vary from student to student and from university to university.

The high dropout rate among freshman engineering students at the Central University of Technology (CUT) (“Central University of Technology,”), is due to the high student volume, poor academic background, poor motivation of students and poor preparation for examinations as per previous research (RB Kuriakose, 2014). While the first two reasons are to an extent inherent, the last two reasons may be due to a lack of effective communication between students and faculty.

Academic feedback can be seen as an ideal way of carrying out effective communication between students and faculty (Dowden et al, 2013). Previous research, in the field of economics and finance, shows that students are constructively affected when they receive prompt and constructive feedback (Rowe & Wood, 2008). Feedback is also closely linked with student retention and progression (Bloxham & West, 2004; Yorke, 2014). However, there is also research that suggests that feedback is often not read at all or not even understood by students (Brown, 2001). In some instances, students have shown dissatisfaction with the adequacy of feedback (Krause et al 2005). The research question therefore arises “What are student perceptions of academic feedback and are they receiving it with their assessments”?

The aim of this paper is to present the perceptions of freshman engineering students with regard to academic feedback. The hypothesis is that these perceptions will shed light on why students tend to dropout in their freshman year and enable faculty to setup certain interventions to help mitigate this concern. The paper firstly considers what constitutes feedback in academia and then follows with its importance in the learning cycle. Secondly, the research methodology, results and discussions are provided

2. Feedback in an academic context

Feedback, in very simple terms, is a consequence of performance (Hattie, & Timperley, 2007). It can be conceptualized as information provided by an agent with the aim of improving or enlightening the recipient (Hattie et al., 2007). In an academic context, feedback is often related, to but not restricted to, assessments.

Assessment of student learning can be defined as the systematic collection of information about student learning, using the time, knowledge, expertise, and resources available (Walvoord, 2010). Its purpose is to justify to students how their grade was obtained, as well as to reward specific qualities and recommend aspects that need improvement (UNSW Australia, 2010). Effective feedback is characterized by the following: (Race, 2005);

- It must be timely – Ideally, feedback should be received within a day or two.
- It needs to be intimate and individual – Feedback needs to fit each student’s achievement, individual nature and personality.
- It should be empowering – Feedback must be constructive in most instances, strengthening and consolidating learning.
- It must be precise – Feedback must be used to improve the performance of the student, hence one worded feedback like ‘weak’, ‘poor’ or even ‘excellent’ should be avoided. As a result the feedback should be precise as what is right and what needs to be improved.
- It needs to be manageable – Feedback should be such that it is manageable to both lecturers and students. Designing and delivering feedback is a very tedious process, especially if it’s a large class. Similarly, too much or too little feedback to students can result in reducing their opportunity to benefit from the feedback and in improving their learning.

There are different types of strategies that can be used to provide effective feedback to students. For the purposes of this research, two common feedback strategies are compared and contrasted. They are (Race, 2005);

- Written feedback: used to give feedback to students on reports, essays and mathematical calculations. Usually needs to be short and concise.
- Oral feedback: used to give face-to-face feedback to students on any work done relating to the module.

Each of these feedback strategies has its own advantages and disadvantages (Race, 2005). The major advantage of written feedback is that students can refer to it again and continue the learning process, while the disadvantage is that it is time consuming for the provider (see Table 1).

Oral feedback, on the other hand, can be seen as a more personal approach, as students may feel that the lecturer is ‘looking out’ for them. Unfortunately, this is also a disadvantage as some students might feel threatened by a personal approach and often forget the message. Table 2 describes in detail more advantages and disadvantages of oral feedback.

Table 1. Advantages and disadvantages of written feedback

Advantages	Disadvantages
Feedback can be personal, individual, and directly related to the particular piece of work.	Handwritten feedback can be hard to read
Feedback may be regarded as authoritative and credible.	When critical, handwritten feedback - because of its authoritativeness - can be threatening.
The feedback can be tailored to justify an accompanying assessment judgment.	It is slow and time-consuming to write individually on (or about) students' work, especially in large classes.
Students can refer to the feedback again and again, and continue to learn from it.	Cannot refer to the feedback given to the students unless one keeps photocopies of their work with the comments.
Such feedback provides useful evidence for external scrutiny	It becomes too tempting to degenerate into shorthand - ticks and crosses - rather than to express constructive and critical comments.

Table 2. Advantages and disadvantages of oral feedback

Advantages	Disadvantages
Feedback is likely to be found to be personal, intimate and authoritative.	One-to-one feedback can be extremely threatening when critical.
Can address each individual student's needs, strengths and weaknesses.	Students can be embarrassed when receiving constructive feedback and this can cause them not to fully benefit from praise.
Often much quicker to talk rather than write or type.	It takes a great deal of time to organize individual appointments with each member of large classes.
Students might feel at ease to approach lecturer in future with problems or queries.	It becomes impossible to remember exactly what the lecturer said to whom, when class sizes are large.

3. Importance of constructive feedback in learning cycle

Based on the feedback strategies discussed in the last section, feedback can be further classified as being constructive (or positive) feedback and critical (or negative) feedback. Critical feedback is usually not well-received and makes people defensive (Race, 2005) especially if it is provided in an unskilled manner (The University of Nottingham, 2012). On the other hand, constructive feedback increases self-awareness, offers guidance and encourages development (Hamid & Mahmood, 2010). Constructive feedback is an important factor in learning. It differs from feedback in that it has the ability to enhance learning in three significant ways (Hounsell, 2007). This is by;

- Accelerating learning: speeding up what can be learned by the students within a given period of time and so enabling learning to take place more rapidly, or in greater depth or scope.
- Optimizing the quality of what is learned: helping to ensure that the learning outcomes achieved and evinced by the students meet the standards hoped for or required.
- Raising individual and collective attainment: enabling students to attain standards or levels of achievement higher than those which they might otherwise have reached.

The importance of constructive feedback in learning is highlighted in Kolb's experiential learning theory (Kolb, Boyatzis, & Mainemelis, 2000). It is illustrated as a cycle shown in Figure 1. An application of the learning cycle with reference to assessments in a classroom

follows figure 1 which shows the impact that constructive feedback can have on the learning process.

Each of these stages can be linked to students engaging with assessments. Concrete experience to the student may refer to the experience of completing the assessment. It can be formative or summative. Reflective observation may refer to the constructive feedback provided by the lecturer in reference to the performance in the assessment which concluded as the concrete experience. The abstract conceptualization may refer to the time the student uses to understand the constructive feedback, processing ideas and integrating them into logical theories. The final stage is that of active experimentation, where the student uses the theories that were conceptualized in the previous stage to improve on either the current assessment or future ones.

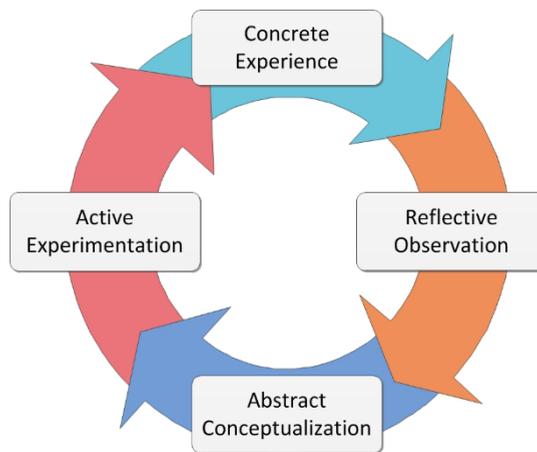


Figure 1: Kolb's learning cycle

Abstract conceptualization is a critical stage where students learn from previous mistakes and creates a path for the coming assessment. This is where constructive feedback is seen as an integral part to learning. It is substantiated by other researchers (Azevedo, R., & Bernard, 1995)(Bangert-Drowns, R. L., Kulik, C. C., Kulik, J. A., & Morgan, 1991) who regard constructive feedback as crucial to improving knowledge and skill acquisition. Furthermore, constructive feedback is also seen as a significant factor in motivating student learning (Narciss, 2013).

4. Research Methodology

An exploratory study is employed along with descriptive statistics involving quantitative analysis of the collected data. An exploratory design may set the stage for future research and usually involves only a single group of respondents (Jara & Mellar, 2010). Descriptive

statistics are used as the results are interpreted with regard to specific freshman engineering students enrolled at CUT. Quantitative analysis is important as it brings a methodical approach to the decision-making process, given that qualitative factors such as “gut feel” may make decisions biased and less than rational (Reddy, W, Higgins, D, Wakefield, 2014).

The target population was restricted to freshman engineering students enrolled for Digital Systems I during 2015 (n = 98). An electronic response system (ERS) was used in a classroom environment to obtain student perceptions on specific questions relating to the practical work done in the laboratory. Closed-ended questions, featuring Likert scales, were used based on previous research which focused on student perceptions of practical work done in a laboratory (A. Swart, 2012)(A. J. Swart, 2014). Using this ERS in a classroom environment ensured a high response rate, while the closed-ended questions did not require the participants to express lengthy views. Entering long sentences via the ERS is rather cumbersome and tedious.

The survey was done after the students completed a class test. The results of the study are presented in two sections. The first section shows what students are currently experiencing as feedback in their classroom. The second section shows what they perceive to be good feedback.

5. Results

The first question of the survey focused on obtaining student perceptions with regard to what academic feedback they have received thus far at the university. The results showed that 49% (agreed or strongly agreed) of students felt receiving a mark on a notice board or paper constituted feedback. This is shown in Figure 2. 42% of the students indicated that they had received written comments on their assessment while up to 64% received oral feedback. These results are shown in Figures 3 and 4.

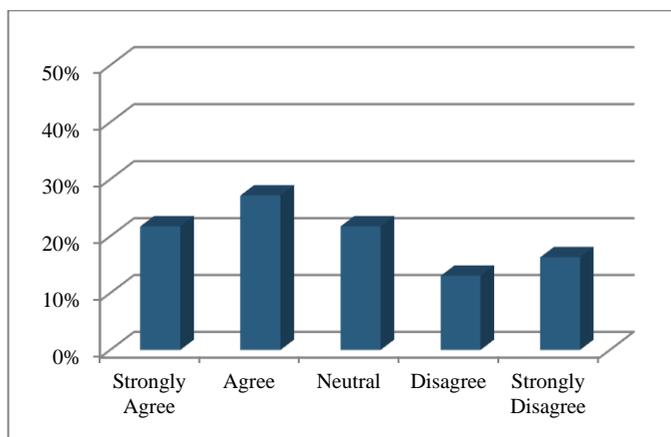


Figure 2: Student response to question if they thought feedback means receiving marks on a notice board or on paper

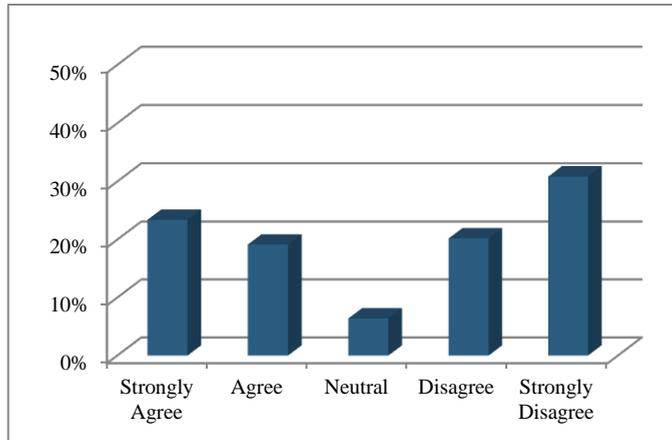


Figure 3: Student response to question if they received written comments on how to improve for the next theory test

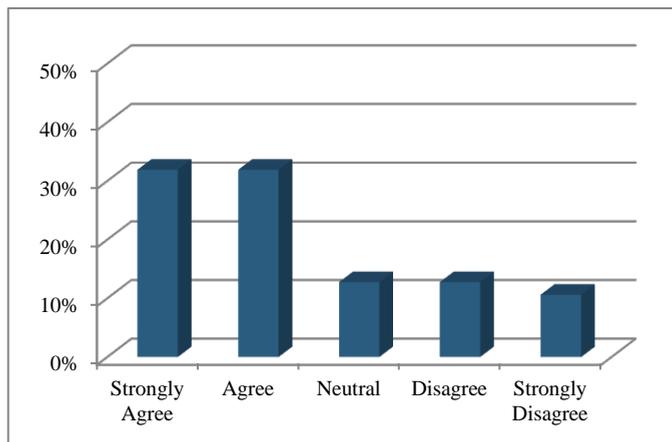


Figure 4: Student response to question if they received oral comments on how to improve for the next theory test

The second section focused on obtaining the perceptions of students towards academic feedback. The first question in this regard tried to ascertain if students felt that it is important for a lecturer to provide constructive feedback on their tests (see Figure 5). 80% of students agreed (agreed or strongly agreed) that they valued constructive feedback from the lecturer. As a follow up question, they were asked to share their perception on critical feedback from the lecturer. 49% felt that critical feedback should be given by the lecturer as shown in Figure 6.

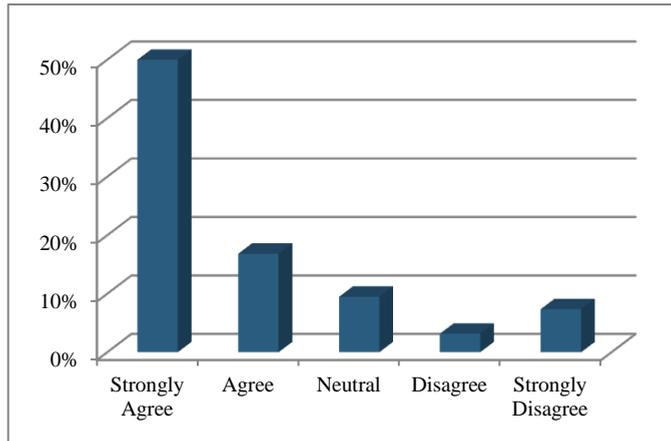


Figure 5: Student response to question if it is important for lecturers to provide constructive feedback

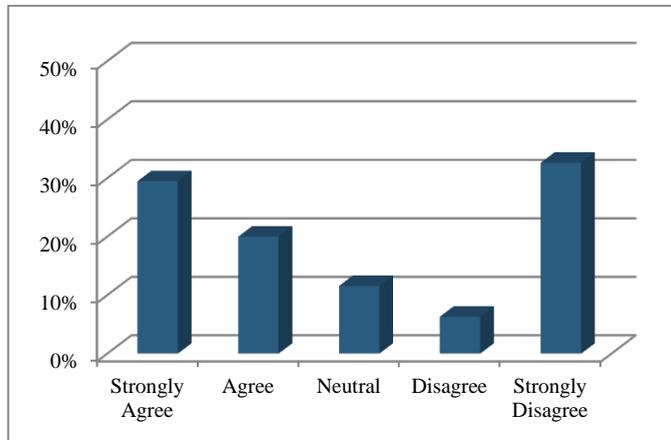


Figure 6: Student response to question if it is important for lecturers to provide critical feedback

6. Discussions

Figure 2 revealed that almost half of the class has the perception that a mark on a paper or notice board is what constitutes academic feedback. This misconception may stem from the school environment where a grade may serve to motivate or punish some students and not be an effective communication tool (Jason, 2014). As this survey was associated with freshman engineering students, their answer to this question may be attributed to their short exposure to university life.

The second and third questions, illustrated in Figures 3 and 4, are related to the students' experience of feedback at university. These figures show that students received very little written feedback, while there was considerable oral feedback. While not touting it as an

excuse, one reason for little written feedback has been attributed to large class sizes (Jin & Cortazzi, 2013), which is the case in this module.

Students further desire more constructive feedback than critical feedback from their lecturers. This is shown in Figures 5 and 6. They feel with constructive feedback they would be more motivated to improve on future assessments (Burke, 2007). At the same time, Figure 6 shows that only 35% of the students disagree or strongly disagree to critical feedback. This shows that there is room for the “feedback sandwich” approach identified by Boud and Molly (Chokwe, 2015) which states that negative feedback needs to be sandwiched between two positive comments. Students further felt that written feedback is imperative to their learning. It would help them to engage in self-reflection and enable them to approach the lecturer for further clarity (McGill, 2007).

7. Conclusions

The purpose of this paper was to gain insight into the perceptions of freshman engineering students with regard to academic feedback. The results were split into two sections, student perceptions of feedback and their actual experience. The survey was conducted after the students wrote their first class test where a key result indicated that they are not receiving sufficient written feedback. This lack of feedback can result in students repeating mistakes and eventually failing the course or even dropping out of the programme.

The freshman students may not have had a very clear idea of what academic feedback in a university setting really entails, as they may still relate to feedback from their school days [27]. But they believe that constructive feedback will enable them to reflect on the work they have done and improve on future assessments. They further believe that constructive feedback will bridge the gap between them and their lecturer.

A limitation of this study is that it is restricted to a single semester with the questionnaire administered at the very beginning. A similar survey should be done at the end of the semester to see if there is a variable change in the perception of students. Using a time-lag study may further enhance the results.

A key recommendation in this case would be to find a mechanism or technique of addressing this concern. If this cannot be done for the entire class, then it should be attempted for at least those students who score below 50% for their first test. This could serve as a necessary intervention to help provide both constructive and critical feedback that has the power to change the educational world of students.

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Comparative analysis of higher education study programs' quality, efficiency and effectiveness

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Abstract

Many definitions of quality, efficiency and effectiveness exist in literature and can be considered as the relationships between inputs, outputs and outcomes. From this point of view efficiency may be defined simply as the relation of outputs to inputs, effectiveness as the relation of outcomes to outputs and inputs, but quality as a measure of change of outputs and outcomes. The objective of this paper is evaluation of higher education study programs quality, efficiency and effectiveness in the case of Latvia University of Agriculture engineering study programs. The conceptual framework of quality, efficiency and effectiveness was defined, which allow to perform the comparative analyze of the study programs inputs, outputs and outcomes depending on the study year. It is concluded that even the quality, as the change of inputs or outputs, decreases, at the same time the quality, as the change of outcomes, can increase. If the efficiency of study program, as the relation of outputs to inputs, decreases at the same time the effectiveness of the study program, as the relation of outcomes to outputs or inputs, can increase depending on study year.

Keywords: *Quality; efficiency; effectiveness; inputs; outputs; outcomes.*

1. Introduction

Many definitions of quality, efficiency and effectiveness exist in literature, as the result these terms have often been used synonymously and inconsistently (Colby, Witt, 2000). Quality may be defined as the conformance of requirement, being fit to use and its definition depends on the applied context and measures. Quality in higher education is a term that is commonly considered to indicate a high level of all stakeholders, primarily students, satisfaction with obtained suitable results at University (Lupo, 2013).

The term effective is used, when associated concept is adequate to accomplish a purpose, producing the intended or expected result. In turn, efficient term describes performing or functioning in the best possible manner with the least waste of the time and effort. Effectiveness is often referred to as doing the right thing; while efficiency is doing things right (The Pennsylvania State University, 2006).

Quality, efficiency and effectiveness usually are associated with the concepts of outputs, outcomes, process or inputs. Outputs typically refer to changes in student achievement, completion rates, certification, skills, and certain attitudes and values. The outcomes are directly influenced by political choice in the longer time, such as employment, earnings and values. Inputs provide the preconditions for the core transformation process in organisations (Scheerens, Luyten & van Ravens, 2011) such as characteristics of teaching staff, students, facilities, curriculum, and other resources. Quality is often defined, synonymously with effectiveness, as the degree to which objectives are met or desired levels of accomplishment achieved (Adams, 1993).

The evaluation of quality, efficiency and effectiveness can be considered as the relationships between inputs, outputs and outcomes. From this point of view efficiency may be defined simply as the relation of outputs to inputs, effectiveness as the relation of outcomes to outputs and inputs, but quality as a measure of change of outputs and outcomes.

According to the Europe 2020 strategy Latvia has developed the National Reform Program as part of the growth strategy and has established the purpose to improve the public spending efficiency in higher education and research institutions. The main problem of higher education modernization is the right balance between inputs and relevant outputs (Arhipova, 2014). In research (Paura, Arhipova, 2014) the Latvia University of Agriculture strategic policy to increase the number of enrolled and graduated students has evaluated in respect to the causes of the first year students' dropout rates.

The objective of this paper is evaluation of higher education study programs' quality, efficiency and effectiveness in the case of Latvia University of Agriculture engineering study programs.

2. Conceptual framework of quality, efficiency and effectiveness

One of existing approaches for study program quality evaluation is accreditation to assess of study program's compliance with government regulations. Latvia provides that each higher education institution and study program requires accreditation. According to Latvian legislation specific requirements for the evaluation of a study program are developed (Cabinet of Ministers of the Republic of Latvia, 2015). High school, college and study direction accreditation rules requirements of higher education programs in Latvia consist of seven groups: Study program management; Study program content; Financial and material resources, human resources; Research quality; International cooperation; Quality assurance and Graduated students.

The following input indicators can be defined: financial and material resources (higher educational expenditure per student, proportion of public and private investments, public investment in research and development, percentage of spending on salaries for teaching staff and administrative personnel, higher education institution infrastructure); human resources (teaching staff professional knowledge and skills, working time, career structures, training and certification requirements) and student enrolment data. The output indicators can be defined as scores or proportion of graduated students, test scores, number of research publications, employment statistics, while outcome indicators can be defined as quality of developed skills, graduation rates and drop-out rates.

At the initial step of the evaluation authors offer to use the efficiency and effectiveness simple in the relative term, but the quality in absolute term. In other words, efficiency is the relation of outputs to inputs. Effectiveness is the relation of outcomes to outputs or effectiveness can be defined as the relation of outcomes to inputs, while quality is the change of outputs or outcomes (Fig. 1).

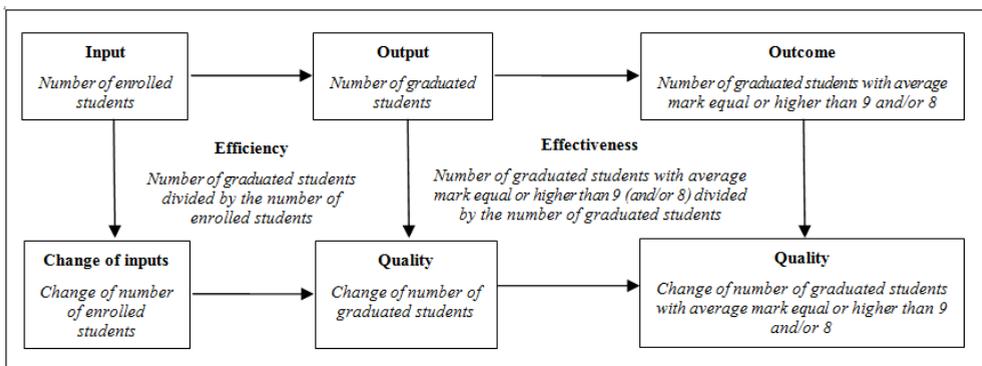


Figure 1. Conceptual framework of study program quality, efficiency and effectiveness with respect to inputs, outputs and outcomes

The Figure 1 provides the conceptual framework of study program' efficiency and effectiveness with respect to the relationships between inputs, outputs and outcomes (Mandl, Dierx, & Ilzkovitz, 2008), which is supplemented by additional concept of quality and definitions of the quality, efficiency and effectiveness.

3. Quality, efficiency and effectiveness of the study programs

In the process of study program evaluation the learning outcomes for practical study courses should be defined clearly and practically organized. Improving the program quality, it is necessary to organize self-evaluation measurements, where the following indicators for study programs evaluation can be used: student enrolment data for inputs; scores or proportion of graduated students for outputs; and graduation rates, drop-out rates for outcomes. For the study programs comparative evaluation two full-time bachelor study programs "Computer control and computer science" (CCCS) and "Information technology for sustainably development" (ITSD) were chose in Latvia University of Agriculture in case, when students have enrolled in 2011/2012 or 2012/2013 study year, graduated in 2015 or 2016 accordingly and have completed 240 ECTS during four academic years. Table 1 indicates the inputs, outputs and outcomes indicators used in the empirical data analysis and for the calculation of the study programs efficiency scores.

Table 1. Study programs input, output and outcomes indicators

Indicator	Study year	Study program		Total
		CCCS	ITSD	
Input: the number of enrolled students	2011/2012	61	30	91
	2012/2013	56	25	81
Output: the number of graduated students	2014/2015	22	10	32
	2015/2016	14	14	28
Outcome 1: the number of graduated students with average mark equal or higher than 9	2014/2015	1	0	1
	2015/2016	2	3	5
Outcome 2: the number of graduated students with average mark equal or higher than 8	2014/2015	5	1	6
	2015/2016	2	5	7

In the quality terms the study programs' input in 2012/2013 study year and output in 2015/2016 are decreased, except for ITSD study program, where the number of graduated students is increased. As opposed the number of graduated students with average mark equal or higher than 9 and/or 8 is increased in 2015/2016, except for CCCS study program, where the number of graduated students with average mark equal or higher than 8 is decreased. It can be concluded, that the total quality of study program as a measure of change of outputs is decreased, but the total quality of study program as a measure of change of outcomes is increased. The quality of the each study program as well as total for two programs is presented in Table 2.

Table 2. Quality of study programs as a measure of change of outputs and outcomes

Quality	Study year	Study program		Total
		CCCS	ITSD	
Change of inputs: number of enrolled students	2011/2012			
	2012/2013	- 5	- 5	- 10
Change of outputs: number of graduated students	2014/2015	- 8	+ 4	- 4
	2015/2016			
Change of outcome 1: number of graduated students with average mark equal or higher than 9	2014/2015	+ 1	+ 3	+ 4
	2015/2016			
Change of outcome 2: number of graduated students with average mark equal or higher than 8	2014/2015	- 3	+ 4	+ 1
	2015/2016			

According the proposed definition efficiency is the relation of outputs to inputs or efficiency of the study programs is equal number of graduated students divided by the number of enrolled students. As the results the efficiency of the CCCS study program in 2015/2016 study year is decreased, but the efficiency of the ITSD study program is increased. The total efficiency of both study programs in 2015/2016 study year slightly less than in previous study year (Table 3).

Table 3. Efficiency of study programs as the relation of outputs to inputs

Efficiency	Study year	Study program		Total
		CCCS	ITSD	
The number of graduated students divided by the number of enrolled students	2014/2015	36.1%	33.3%	35.2%
	2015/2016	25.0%	56.0%	34.6%

Effectiveness is the relation of outcomes to outputs or effectiveness of the study programs is number of graduated students with average mark equal or higher than 9 and/or 8 divided by the number of graduated students. It is concluded that the effectiveness of the CCCS study program is increased in the case for the graduated students with average mark equal or higher than 9 and decreased for the graduated students with average mark equal or higher than 8. At the same time the effectiveness of the ITSD study program is increased in both cases. The total effectiveness of two study programs is increased. The study programs effectiveness as the relation of outcomes to outputs depending on study year is given in Table 4.

Table 4. Effectiveness of study programs as the relation of outcomes to outputs

Effectiveness	Study year	Study program		Total
		CCCS	ITSD	
The number of graduated students with average mark equal or higher than 9 divided by the number of graduated students	2014/2015	4.5%	0%	3.1%
	2015/2016	14.3%	21.4%	17.9%
The number of graduated students with average mark equal or higher than 8 divided by the number of graduated students	2014/2015	22.7%	10.0%	18.8%
	2015/2016	14.3%	35.7%	25.0%

Using the effectiveness as the relation of outcomes to inputs or effectiveness of the study programs is defined as the number of graduated students with average mark equal or higher than 9 and/or 8 divided by the number of enrolled students it is concluded that the effectiveness of the CCCS study program is increased in the case for the graduated students with average mark equal or higher than 9 and decreased for the graduated students with average mark equal or higher than 8. At the same time the effectiveness of the ITSD study program is increased in the both cases as well the total effectiveness of the two study programs also is increased (Table 5).

Table 5. Effectiveness of study programs as the relation of outcomes to inputs

Effectiveness	Study year	Study program		Total
		CCCS	ITSD	
The number of graduated students with average mark equal or higher than 9 divided by the number of enrolled students	2014/2015	1.6%	0%	1.1%
	2015/2016	3.6%	12.0%	6.2%
The number of graduated students with average mark equal or higher than 8 divided by the number of enrolled students	2014/2015	8.2%	3.3%	6.6%
	2015/2016	3.6%	20.0%	8.6%

The summary of the study programs quality, efficiency and effectiveness tends to increase or decrease with respect to the relationships between inputs, outputs and outcomes is given in the Table 6, where input is defined as the number of enrolled students, output as the number of graduated students, outcome 1 as the number of graduated students with average mark equal or higher than 9 and outcome 2 as the number of graduated students with average mark equal or higher than 8.

Table 6. Summary of the study programs quality, efficiency and effectiveness tends to increase (↑) or decrease (↓) with respect to the relationships between inputs, outputs and outcomes.

Study programs	CCCS	ITSD	Total
Quality as change of inputs	↓	↓	↓
Quality as change of outputs	↓	↑	↓
Quality as change of outcomes 1	↑	↑	↑
Quality as change of outcomes 2	↓	↑	↑
Efficiency as the relation of output to input	↓	↑	↓
Effectiveness as the relation of outcome 1 to output	↑	↑	↑
Effectiveness as the relation of outcome 2 to output	↓	↑	↑
Effectiveness as the relation of outcome 1 to input	↑	↑	↑
Effectiveness as the relation of outcome 2 to input	↓	↑	↑

Therefore it can be concluded that even the quality, as the change of input or output decreases, at the same time the quality, as the change of outcome, can increase. If the efficiency of study program, as the relation of output to input, decreases at the same time the effectiveness of the study program, as the relation of outcome to output or input, can increase depending on study year. The evaluation of quality, efficiency and effectiveness should be provided under the common framework as the relationships between inputs, outputs and outcomes.

4. Conclusions

The evaluation of quality, efficiency and effectiveness can be considered as the relationships between inputs, outputs and outcomes. From this point of view efficiency may be defined simply as the relation of outputs to inputs, effectiveness as the relation of outcomes to outputs and inputs, but quality as a measure of change of outputs and outcomes.

The conceptual framework of quality, efficiency and effectiveness allow to perform the comparative analyze of the student learning inputs, outputs and outcome depending on the study year.

The study programs inputs, outputs and outcome have analyzed and the comparative analyze of student learning in the engineering study programs of Latvia University of Agriculture was made. It is concluded that even the quality, as the change of input or output, decreases, at the same time the quality, as the change of outcome, can increase. If the efficiency of study program, as the relation of output to input, decreases at the same time the effectiveness of the study program, as the relation of outcome to output or input, can increase depending on study year.

The evaluation of quality, efficiency and effectiveness should be provided under the common framework as the relationships between inputs, outputs and outcomes.

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The Unisa KZN Students' Perspectives of Student Success

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Abstract

This paper aims to present what students refer to as 'student success' based on their own lived experiences and perceptions. It also aims at presenting a proposal towards developing an integrated model for learner support whose objective is to identify students' academic and career needs at the point of entry; refer them to appropriate learning and career development programmes; and thereafter enrol them in a job readiness training and placement programme (JRTP) in preparation for work-integrated learning (WIL) placements.

A mixed methods study was conducted, involving a diagnostic academic literacies assessment, student questionnaires as well as focus group discussions. Participants were the KwaZulu-Natal (KZN)-based Unisa students who had been placed in WIL programmes with and/or without the career development and JRTP experience, and those that had been placed in other jobs not directly related to their qualifications and/or career needs through the JRTP programme.

It was found that most senior students view student success as obtaining a qualification, and being able to use such qualification in gainful employment, whereas junior students placed most emphasis on obtaining a qualification. It was also found that most of the JRTP students perceived the programme as having been helpful in them landing and retaining jobs.

Keywords: *Academic Development ; Career Development; Job Readiness Training & Placement; Success.*

1. Introduction

This paper aims at proposing a development of an integrated model for learner support whose objective is to identify students' academic and career needs at the point of entry; refer them to appropriate learning and career development programmes; and thereafter enrol them in a job readiness training and placement programme (JRTP) in preparation for work-integrated learning (WIL) placements.

2. Research Questions

The fact that the high unemployment rate in SA is not only limited to the uneducated and unskilled youth, but includes a large number of university graduates, raises a number of questions, which I thought I might be able to interrogate through this study. Also, the fact that Unisa has what I would like to believe is a strong learner support system (with Academic Development (AD) programmes, tutors, mentors, peer collaborative learners, etc.) and a mediocre throughput rate, added to the questions alluded to above, which are enumerated below.

The questions I have posed are:

1. Could it be that the unimpressive Unisa throughput rates (Unisa HEMIS, 2013) may be due to AD interventions that are generic and not related to the students' academic and career related needs?
2. Could it be that students are placed in work-seeking situations without being prepared at least for the 'soft skills' required in the world of work and hence the unemployability which might be the cause of the high rates of unemployed graduates?
3. Is there any contribution made by job preparation and career development initiatives towards students' graduateness and employability?

The general aims of the proposed study are firstly to find from Unisa students, who have been employed for at least 3 years, what their perceptions are of how they landed and kept their jobs, and whether or not they had participated in the JRTP and/or WIL programmes. Secondly, I would like to find out from the students what they perceive as student success and to what they ascribe that success to.

In the following paragraph I provide a summarised account of the literature I have reviewed. This review deals with the different ways in which the concept 'success' has been defined by the different scholars in their different contexts. It also deals with student preparation for the world of work, the soft skills imparted to them in such training, as well as studies related to WIL, and how these relate to increased academic performance.

3. Literature Review

The aim of this review is to provide guidance to the study as well as serve as a basis for comparison between its findings and those of previous studies. As stated previously, I hope to shed some light on the questions of student preparation for the world of work, as well as provision of academic and career development interventions, which are not related to students' needs. I am also interested in the students' own perception of 'student success'.

I have therefore selected studies on the basis of how closely they address, in different contexts, questions similar to those posed by this current study as well as those relating to the aims of the proposed study, as has already been stated in the paragraph above. These relate to student success, graduate employability and employment preparation.

3.1. Student success

Numerous studies on student retention and throughput portray a 'single-minded' view of student success, that which measures it as successfully attaining a qualification and thus graduating from institutions of higher learning (Jones-White, Radcliffe, Huesman (Jnr), & Kellog, 2010; Pauw, Borat, Goga, Ncube, & van der Westhuizen, 2009; Tinto, 2012; Lee Harvey, 2010). This view of student success has been labelled as being institution-centred rather than being student-centred (Jones-White et al, 2010). This is what Jennings, Lovett, Cuba, Swingle and Lindkvist (2013) so eloquently capture in the following statement:

[W]e will have done our job if our graduates lose themselves in 'general enthusiasms' in 'intellectual discovery' or 'make a difference in the world' (2013; 1).

Most studies revealed that students do not measure their success by the same tools their institutions do, and neither do they view it using the same lenses (Gonsalves and Vijaya, 2008; Cuseo, 2011; Jennings et al, 2013). It has emerged that students have different ways of 'defining' student success, with emphasis being differentially located. For example, in the Jennings et al study, students list multiple themes when asked to define success in college ... their focus on their success narratives ebbs and flows over time (2013; 6). Whilst Cuseo, (2011; 23) defines student success as:

[A] holistic phenomenon that embraces the multiple dimensions of personal development and the multiple goals of higher education.

3.2 Graduate Employability

Knight and Yorke, 2004 define graduate employability as

“a set of achievements, understandings and personal attributes that make individuals more likely to gain employment and be successful in their chosen occupations” (22).

This definition seems to link directly employability to academic success and personal development and may therefore suggest that for individuals to attain employability, they may need to be educated. This notion seems to be supported by numerous researchers as indicated below.

Both national and international studies on student perceptions and opinions regarding graduate unemployment suggest that students see it as the function of institutions of higher learning to ensure that on qualification, they are employable (Wu, 2011; Pauw et al, 2009; Tomlinson, 2008), as suggested by the following extract:

The results indicate that undergraduates strategically arranged their courses so as to increase their employability to cope with the high college graduate unemployment rate, even though the practical and credential-related courses that they favoured resulted in heavier course loads. Evidently, undergraduates took initiative in increasing and developing their working competencies and employability to strengthen their future competitiveness in a cutthroat labor market (Wu, 2011; 308).

The recommendations from the Lowden, Hall, Elliot and Lewin (2011) study also link the functions of the institutions of higher learning to the development of graduate employability. Lee Harvey (2000; 14) sums up the interface between higher education and the world of work,) by stating that:

The 'New Realities' that ask searching questions about the relationship between higher education and employment are, incidentally, asking about the purpose and structure of higher education.

3.3 Graduate Employment Preparation

Studies reviewed reveal that participants in graduate employment preparation programmes reported positive experiences with these, citing the benefits of having undergone such training (Lowden et al, 2011; McKinnon and Wood, 2012). According to these authors, the employers too reported satisfaction with the skills expected of the new graduate intake so much that some expressed that they reportedly appreciated the knowledge transfer opportunity and valued their work with the students as a useful recruitment tool.

4. Methodology

In this section I provide summaries of how I have conducted the study in terms of research design, sampling and data generation and analysis methods applied. I detail these summaries below in the order stated so as to elucidate how I would extract the participants' perceptions and lived experiences, as I wanted to find out what I perceive as having been either helpful or not in their university preparation for academic preparedness and the world of work. I provide an account of the chosen research design below, in the following paragraph.

4.1 Research design

This is a mixed methods study which is hoped to contribute towards development of an integrated learner support model. For the qualitative part of the study I employed a phenomenological methodological framework, which have been consistently applied right through the phases of the study. I am aware of my assumptions that institutions of learning should prepare students for a world of work as part of life-long learning as influenced in part by literature; and as such have bracketed these.

For the quantitative part, I have chosen a non-experimental design, specifically descriptive survey, as I believe that it has a close relationship with the phenomenological research. This belief is based on the assertion that descriptive survey is ...

...[T]he method of research that looks with intense accuracy at the phenomena of the moment and then describes precisely what the researcher sees Leedy (1997, 190).

I also administered a diagnostic assessment tool, which I envisage that if carried out in conjunction with career assessment as pre-requisite to admission, provides a learner profile for specific, needs-focused academic and career guidance, counselling, mapping and pathing interventions. In this way I hope to develop a model that seeks to provide information about learners' academic and career strengths and areas requiring further development, as well as their career orientation.

The sampling method I conducted is outlined in the paragraph below.

4.2 Sampling

I purposively selected a group of Unisa students who have been through the JRTP programme and have been placed at Unisa as employees for at least 3 years irrespective of their career choices and/or aspirations. This sample forms the first category of students. The second category comprises of Unisa students who had never been part of the JRTP but had been placed in jobs related to their career choices or at least in line with their studies at Unisa, either in internships, apprenticeships, learnerships etc. through the WIL programme.

4.3 Data generation/collection

As stated previously in the foregoing sections, this is a mixed methods approach to data generation/collection involving an on-line diagnostic academic literacies assessment, on-line surveys for the students as well as focus group discussions. I facilitated three focus group discussions for each of the two categories of students.

The data generation and collection methods imply investigating the participants' perceptions and lived experiences, and therefore lend themselves to a number of ethical considerations. I provide an account of how I dealt with these in the following section.

4.4 Ethical considerations

I was granted ethical clearance on submission of an application where I declared how I would ensure that participants give consent to partaking in the study by signing a consent letter. I also ensured participant anonymity by utilising pseudonyms for both participants and their institutions. In focus groups, participants were sworn to secrecy and/or confidentiality. None of the participants have been exposed to any kind of harm as a result of participating in the study. A sample of the consent letter is appended to this paper.

4.5 Data analysis

Qualitative data were analysed by utilising a computer aided qualitative data analysis software (CAQDAS) referred to as Atlas ti, whilst data obtained by quantitative means were analysed by Computer Aided Quantitative Data Analysis Software (CAQDAS) programmes referred to as SPSS and classical item analysis (CIA).

5. Findings

In this section I present findings of the study relating to student success, employability and employment preparation from the students' perspectives.

Students had different understandings or definitions of student success. Some seemed to perceive student success with the same lenses as most institutions of higher learning, especially the younger ones – obtaining a qualification. The older students added to their understanding of student success issues of life and citizenry such as reflected in the extract below:

“If Unisa offers us life-long learning, if I am to achieve success in that kind of learning, it should not end when I graduate, it should extend to my full contribution to the economy of the country... and that is by obtaining gainful employment” (BA Hons student)

I found it interesting that of the 120 students that responded, most refer to student success as a combination of academic success and finding employment on graduation as depicted by Figure 1 below.

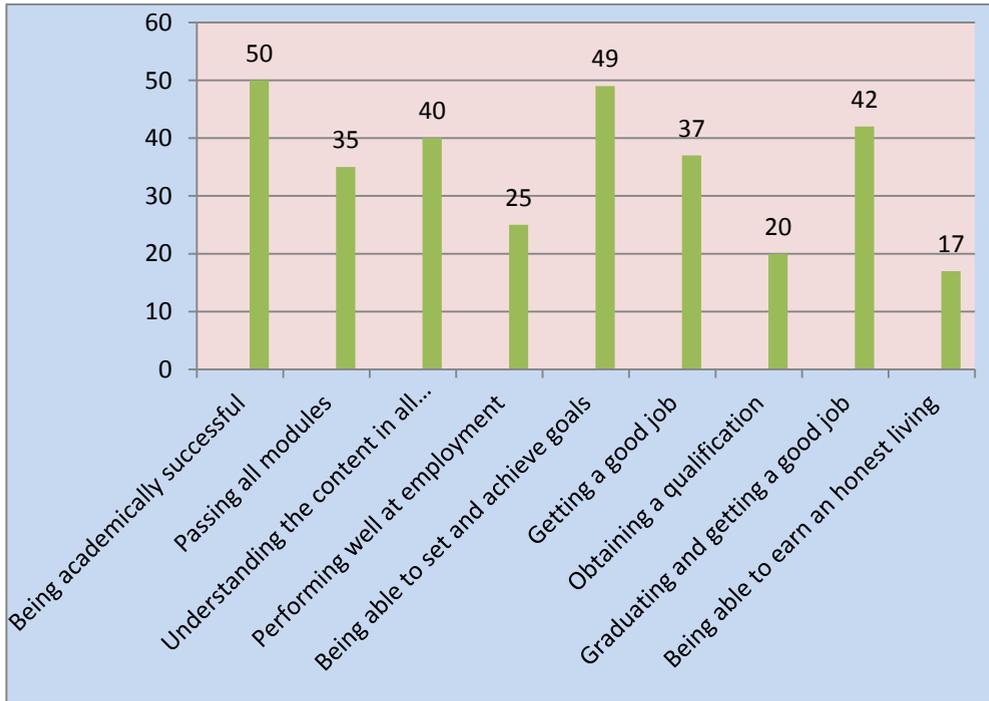


Figure1: Illustration of what is stated in the paragraph above

This implies that students believe that university education should equip them with the kind of outcomes that can lead to being employed. Such findings corroborate the findings of some of the studies reviewed for this project (Cuseo, 2011; Gonsalves, 2008; Tomlinson, 2008; & Lee Harvey, 2000).

Most of the students that have been exposed to the job readiness and placement programme reported positive experiences in their placement institutions including gaining experience they could use in future career-related employment.

6. Conclusion

Mixed methods study, though leaning heavily on phenomenology, is envisaged as appropriate in accommodating the best of both worlds of qualitative and quantitative research paradigms in terms of offering a rigorous approach to answering research questions (Creswell and Plano Clark, 2007).

It seems evident from the findings of this study that there is some measure of corroboration between previous studies and the current one with regards to the extended definition of

student success as going beyond attaining a qualification. The most recent research undertaken in this regard, which was commissioned by the International Council for open and Distance Education, the ICDE (2015) also has similar findings as the current study. This relates to the student centred extended understanding of student success, where they asserted that employment outcomes form student success. Although the same cannot be said about employability, due to the complex nature of the phenomenon, the current study could not elucidate what the students' understanding of employability is. Most equated employability to employment.

Most students reportedly had mixed feelings about the work-related programmes. This might be due to the notion that Unisa does not seem to have a single consistent programme that deals with this issue. Those that had been through the JRTP programme sang praises for the intervention, whereas the same could not be said of those who had not been through this programme but had been only through the WIL programme.

It is safe to assume that an integration and institutionalization of the programmes would benefit both the students and the employers. It is envisaged that the JRTP programme, due to its nature of imparting 'soft skills' to the students, which most of the literature reviewed see as essential as a contribution towards employability, should be institutionalised and form part of the WIL programme. The integration of the programmes relating to academic and career development as well as job related preparation would ensure that students are supported academically and for employability, thus providing the expected outcomes of life-long learning.

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Flipping the classroom and turning the grades – a solution to teach unbeloved phase diagrams to engineering students

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Abstract

Phase diagrams may simply be described as alloying maps in material science. However, the required thermodynamic background knowledge should be high level and understanding of the cooling procedure of metal melts as well as microstructure of metal alloys is challenging. Common teaching material presents results, but not how to get there and leaves frustrated first year engineering students behind. Knowledge on “how to read” phase diagrams is expected from teachers in advanced courses, but requirements are seldom met by the students. Teaching phase diagrams in an “inverted classroom” scenario is a method to let the students study the science on their own and then take the time to discuss their questions and do extended hands on lectures or exercises in class. Implementing the inverted classroom approach has been proven to be successful in terms of learning outcome, problem solving skills related to phase diagrams and in improving grades. Although the time of preparation is raised by a factor of approximately 4 for 2 four-hour classroom sessions, the positive and sustainable learning outcomes make fun to teach and worth the effort.

Keywords: *phase diagram, lecture films, peer to peer, inverted classroom, flipped classroom, blended learning, first year students.*

1. Teaching concept: “inverted classroom”

The material science course for first year mechanical engineering students at HTW Berlin is taught via the “design-led” teaching approach: Ashby et al. (2013), exceLlus (2016), (Pfennig 2016-1, Pfennig 2016-2). In contrast to the conventional “science-led” teaching approach which begins with the physics and chemistry of materials, progressing from the atomistic through the microstructure to the macroscopic properties: the design led approach starts with the needs of the design and then explains why and how properties can be influenced and changed.

Teaching via “inverted classroom” scenarios, Pfennig (2016), is a method to let the students study the science on their own and then take time to discuss their questions and do extended hands on lectures or exercises in class. Berret (2012), Brame (2015), Fischer and Spannagel (2012), Braun et al. (2012) proved this teaching method successful to gain student’s attention, thus acquire good exam results. Lecture films: OLP (2016), Pfennig (2016-2) were chosen as one of the main resources students acquired their scientific background from besides a variety of teaching material such as micromodule lectures, worksheets and worked solution, mind maps, glossaries, memory sheets, online tests and web-based-trainings wbt: Pfennig und Böge (2015), Pfennig (2016-1). An important issue of the concept is, that the students were able to study individually, self-directed, location-independent, asynchronously and according to their individual tempo. In class there is time to discuss problems, work on exercises and engineering related problems in small groups, share difficulties and thoughts with neighbours and classmates.

In first year material science in mechanical engineering the following themes are taught via “inverted classroom” scenarios indicating improvement of learning skills and grades compared to front classroom teaching methods (Pfennig 2016, Pfennig and Hadwiger 2016, Pfennig and Böge 2015):

- Defects in crystals
- Heat treatment
- Introducing microstructure and materials families
- Phase diagrams and the Iron-Carbon phase diagram
- Hardening mechanism
- Nomenclature of materials
- Steel qualities
- Fibre reinforced polymers
- Introduction to polymers

Still, we believe a mixture of teaching methods prevents boredom, predictability and preferences of certain learning types. Surprising raises grades and learning outcome.

2. Introducing phase diagrams: home assignment and contact time

Phase diagrams and how to interpret, read and transfer their knowledge onto real microstructures of materials seems to be an awful hassle for first year students. Due to the curricula, this theme has to be taught in first year engineering studies at HTW Berlin. Phase diagrams may simply be described as alloying maps in material science. However, the required thermodynamic background knowledge is high level and understanding the cooling procedure of metal melts as well as microstructure of metal alloys is challenging. Common teaching material presents results, but not how to get there and leaves frustrated first year engineering students behind. Knowledge on “how to read” phase diagrams is expected from teachers in advanced courses, but requirements are seldom met by the students. Therefore, it is much more successful, to engage the students into practical work and team assignments where they have to use their knowledge rather than listening, copying notes and memorizing during class.

Self-studying was assigned via “moodle”. The 4-hour lecture on phase diagrams was filmed in SS2015 and cut into 9 videos with distinct headlines, so that each student could easily navigate to understand how to read phase diagrams (figure 1).

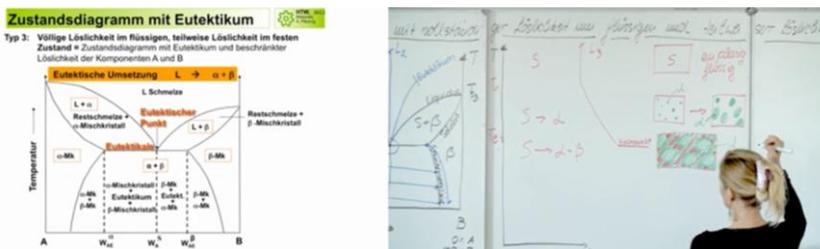


Figure 1. Lecture video: phase diagrams (11 lecture films) (2:35 hours),
(<https://www.youtube.com/playlist?list=PLUOIZMSZYz5zha5EbwAKrQ8w8W65ST3fN>)

In class the open-source software “invote” (invote, 2016) was used for peer reviewing (Simon et al., 2010, Pfennig 2015, Pfennig 2016), to obtain an overview of the student’s knowledge. Questions were answered and important issues explained individually. Students were divided into groups of 4. 12 assignments of different levels were categorized into: 1.) pass the class, 2.) pass with C or B, 3.) pass with A or even better. The students were asked to choose as they felt comfortable. The advantage of teaching small groups was that individual problems were solved and questions of different levels were answered by speaking to the students face to face and meeting her or his needs. Each group received colored cards (green: everything is going well, yellow: we need some guidance, red: urgent

question) so that the lecturer could set priorities on which group to work with without disturbing other groups.

3. Assessment of students learning outcome

A compulsory test had to be taken via “moodle” at the end of the following week and results showed clearly that students had a much better understanding how to work practically with phase diagrams and related problems compared to results of the end of term exam the previous semester. 45% of the students scored very good or excellent in winter semester 2015/16 and even 70% scored very good or excellent in SS 2016 (figure 2).

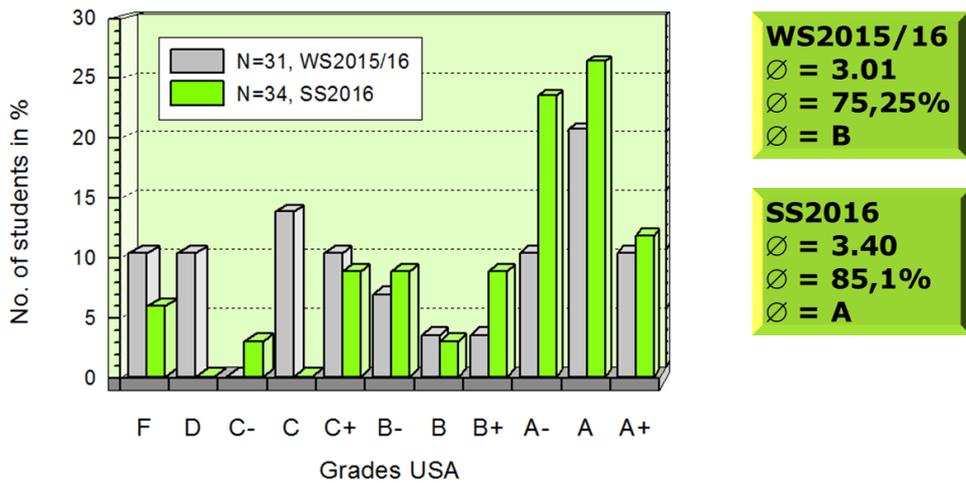


Figure 2: Results of compulsory online exam on phase diagrams.

In the final exams students scored 43% of the phase diagram related problem in SS2015 with no inverted classroom scenario applied (figure 3, left) and 68% in SS2015/16 with phase diagrams being taught by using the inverted classroom approach (figure 3, right).

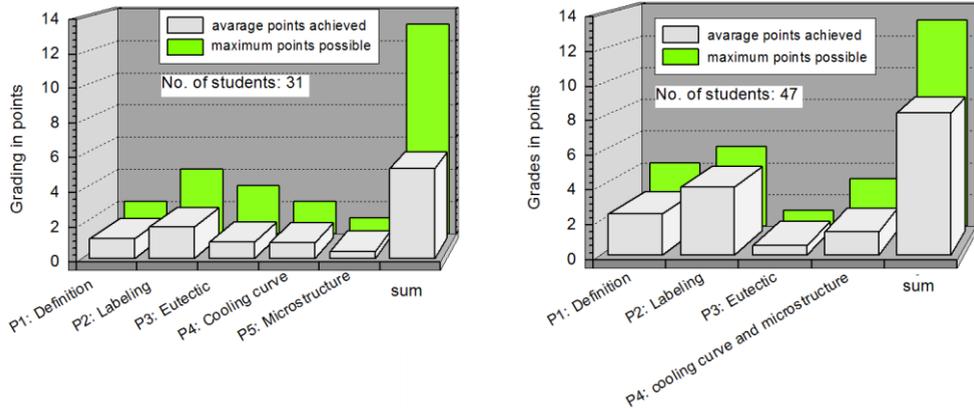


Figure 3. Results of compulsory online exam on phase diagrams, left SS2015, right WS15/16

4. Evaluation of lecture videos

Overall students rated the class as successful (68-73% rated good or excellent), both, in terms of learning output and good study atmosphere in class. Most students rate the repeatability of the film lecture units beneficial. 80% state that videos of lectures may completely replace lectures in presence; only 12% believed that their study progress will only be enhanced in class. None of the lecture films was defined as best or worst with students watching one to all lecture films. Lecture film “Introduction” and “phase diagram with complete solubility” were defined as “easy to follow”. All lecture videos appeared equally beneficial regarding the individual learning process. This represents the diversity of the class and shows that none of the subthemes is liked most. It is remarkable that many students (137) clicked on the entire lecture film (2 hours and 35 min.) and watched an average of 20 min. (ca. 15%) before deciding to go with smaller units.

Some students criticised that during some film minutes board and viewgraph could not be seen together, so that they had difficulties bringing the lecture in order (although viewgraphs were downloaded before the assignment). A good suggestion was to focus on the writing more than on the lecturer during filming. The time slot for phase diagram lecture film preparation was asked to be 14 days and not as is has been here only 7 days.

The author wants to point out that no significant relation between number of clicks and length of the lecture films was analysed (figure 4). The same applies for the time a lecture film was watched as a function of its total length (figure 5). That means that the length of lecture films has no influence on the study behavior of the students. Moreover they decide on their individual needs and interest when watching and studying videos.

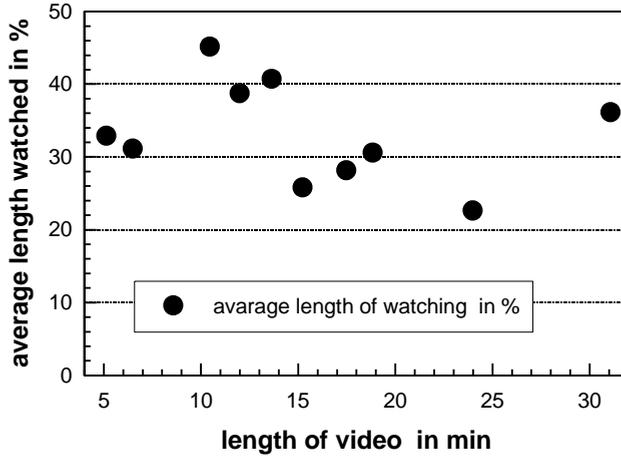


Figure. 4: Average time in % of students watching lecture films in WS2015/16.

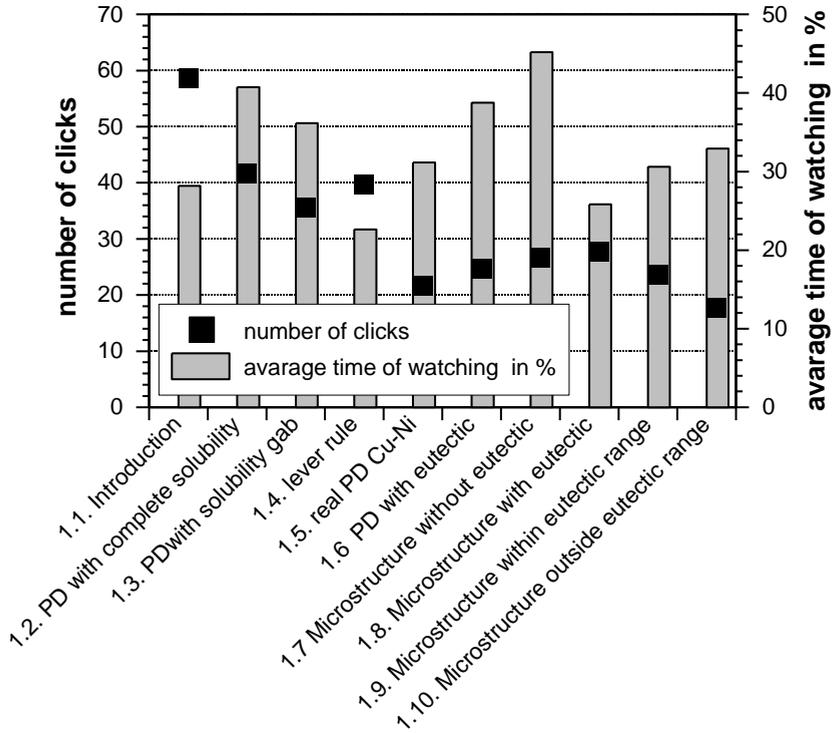


Figure. 5: Clicks and average time in % of students watching lecture films as a function of lecture film unit in WS2015/16, inverted classroom scenario.

All in all, the lecture concept „inverting the classroom” with self-studying based on videos of class lectures was rated positively. Students were eager to work on problem solving in small groups and present their results to the class. 70% of the students brought notes on the lecture films into class showing their serious study period at home helping with the hands on problems in class. Depending on their state of learning students individually chose lecture videos, number of repeats of the same video and the length of time they kept watching continuously.

5. Feedback on the “inverted classroom” concept – drawing a conclusion

Lecture videos as main source of the “inverted classroom concept” are independently reusable once generated and provided. They apply well in the nowadays student`s way of achieving skills. The independence of time and place of the individual lecture in combination with the possibility to repeat whole lectures as well as small parts helps to meet the individual learning velocity of the students. During self-studying students were very motivated to learn, then share their knowledge helping others and contributing to solving problems in class. The pleasant atmosphere in class enabled students to apply their knowledge solving material science problems. Small groups allow for individual explanations and personal contact to students. If both students, who are producing lecture films as well as those learning through them, are given more responsibility for their learning progress critical thinking will be encouraged: CSU (2015), Lord (2012); resulting in deeper learning outcomes: Goto and Schneider (2010), Simon et al. (2010).

There is always the chance of losing students who are not willing to study at home will be lost in the long run, first because of lack of background knowledge, second because they are not able to contribute to group or class work or work on assignments independently. Therefore it is always necessary to be prepared for groups that may not be able to work properly in class. Because the assignment was clear, there is no time for lecturers to let them catch up in class. But, because peers are sitting next to them our experience was that these students prepared themselves very well after the contact time and achieved good grades. In general, the same number of students (35 out of 44) visited the classes regularly compared with the courses taught the traditional way. Time spent studying before class (approx. 4-5h) in the inverted classroom environment equals up to the time estimated to study after class taught in-front to understand and get good grades according to the students.

The method of “inverting the classroom” was assessed as beneficial in terms of student grades, concentration and attentiveness as well as joy of studying. Students took over responsibility for their own learning process and generally achieved better grades than those taught in “front classroom” scenarios.

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Improvement of learning outcome in material science through inverted classroom techniques and alternative course assessment

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Abstract

Material Science is known to first year mechanical engineering students as one of the fundamental courses with high work load. The knowledge of the complex science of materials enables students to select appropriate engineering materials in different designs due to acquired knowledge on the correlation of materials properties, microstructure and their intended manipulation. These abilities are not well constituted in one final exam. Therefore peer-to-peer lecture film supported inverted classroom szenarios were established to work in the course. These were accompanied by a newly developed moodle course following the blended learning approach that gives students the chance to cumulative accomplish micro-grades via multiple activities, such as tests, lectures, presentations, forum discussions, written homeworks and glossary entries. These grades are summed to obtain the overall course grade. Improved learning outcomes are demonstrated in high quality class discussions and most -important to students- in better grades (average 43/60=B) compared to those being assessed by one final exam only (average 39/69=C⁺). The majority of students agreed on enhanced study skills when forced to study throughout the entire semester instead of learning intensely towards the end of the semester. This paper introduces the learning structure as well as graded activities, evaluates the course and compares activity results to former class results.

Keywords: *material science, lecture films, peer to peer, inverted classroom, blended learning, first year students.*

1. Grading in higher education

Grading and reporting on student learning continue to challenge educators. To develop grading and reporting practices that provide quality information about student learning requires clear thinking, careful planning, excellent communication skills, and an overriding concern for the well-being of students: Guskey (2012). Criteria-based approaches to assessment and grading in higher education is widely and controversially discussed due to its educational effectiveness but lack of common understanding in practice. But shifting the primary focus to standards and making criteria secondary could lead to substantial progress: Sadler (2005). The educational benefits of standards-based versus the traditional score-based grading have been quantitatively modeled by: Marbouti (2016) showing that standards-based grading is based on “the measurement of the quality of students proficiency towards achieving well defined course objectives”: Heywood, (2014, p. 1514)

Because standard-based grading assesses students' achievement of the course learning objectives, it provides clear, meaningful, and personalized feedback for students related to achievement of the course learning objectives and helps them identify their weaknesses in the course: Atwood & Siniawski (2014).

2. Introduction to the first semester course material science in mechanical engineering at HTW

Material Science is taught as a compulsory course during first semester undergraduate study subjects such as mechanical, automotive and economical engineering at HTW Berlin based on the “design-led” teaching approach: Ashby et al. (2013), Pfennig (2016-1, Pfennig (2016-2) (figure 1). To prepare students for their role as a maker of things they begin to investigate and learn with a strong practical motive and critically discuss materials, properties, alternative materials and processes as well as the underlying physics and chemistry.

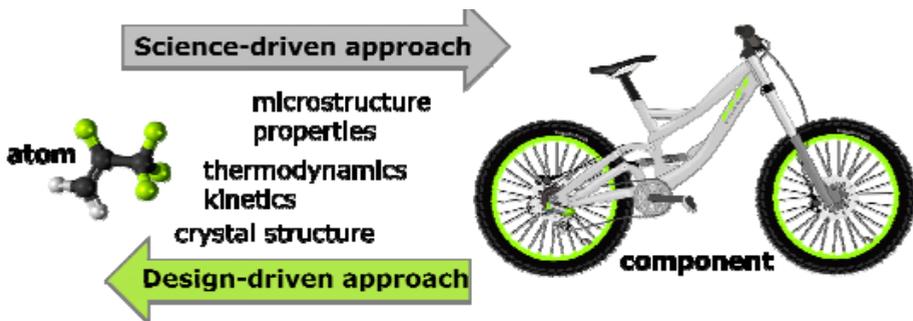


Figure 1. „science-led-approach“ and „design-led-approach“ modified from: Ashby et al. (2013).

Teaching in “inverted classroom” scenarios: Berret (2012), Brame (2015), Fischer and Spannagel (2012), Braun et al. (2012), Pfennig (2016-1) is a method to let the students study the science on their own and then take time to discuss their questions leaving time to work on extended hands on lectures or exercises in class. Peer instruction (Simon et al., 2010) is used to assess the learning progress prior to each class. The method of “blended learning” was found to apply well. Scientific peer-to-peer lecture films: Pfennig (2016-1) and micromodule lectures provided via the content management system moodle are the main learning resources. In addition different teaching materials e.g.: worksheets and worked solution, mindmaps, glossarys, memory sheets, online tests and web-based-trainings WBT are available: Pfennig and Böge (2015), Pfennig (2016-1). Because different learning styles are considered students coming from different scientific and ethnic backgrounds are enabled to study during online periods in equal measure. In class there was time for hands on excercises, discussions, group work and mastering difficult questions. These learning materials were partly contributed by students during material science projects. This peer-to-peer approach: Colorado (2015) and peer reviewing: Ware (2015), Wilson (2012) allows for high teaching standards: Pfennig (2016-1).

In this context the assessment of students learning outcome on one single final exam as usual does not strike as appropriate. The grading system chosen directly connects the course assessments to the course learning objectives and are not a only a series of separate course assignments: Carberry et al. (2012).

3. A new course structure and grading system

It was therefore necessary to decentralize the course assessment and establish step-by-step grades with regard to the learning objectives over the 12 to 16 weeks of the semester. Moodle provides an excellent basis to establish graded activities that are followed each lecture or theme (figure 2). All semester activities count to 50 points, the final moodle exam based on tests during the semester counts for 10 points (in sum 60). Therefore the following activities were weighted appropriately and implemented as compulsory summing to 60 possible points in total:

- 3 Quizzes = 12 questions (each 1)
- 9 Medium tests 20-40 questions (each 2)
- 1 Final test (70 questions) (10)
- 4 Glossary entries (each 1)
- 14 graded lectures (each 3 to 5)
- 3 homework assignment (each 2)
- 2 Forum entries (each 2)

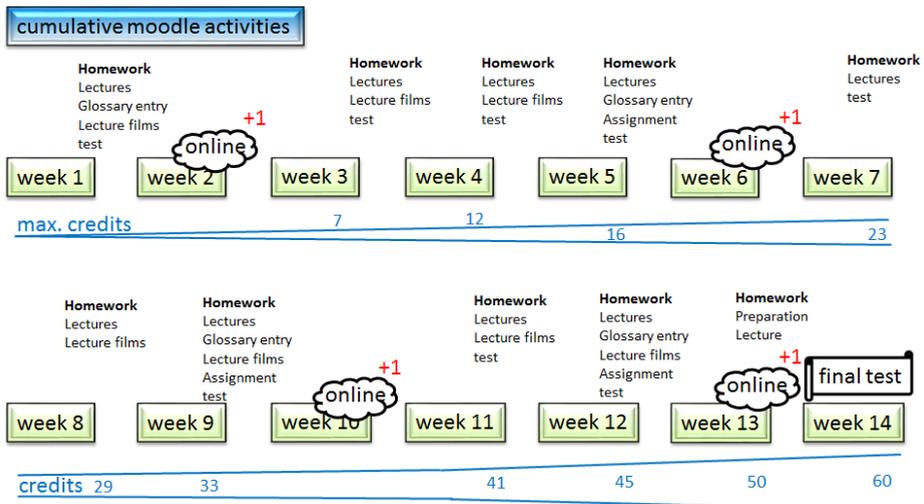


Figure 2. Workflow, Grading and Assignments in the moodle based materials science course (5 ECTS)

Alternatively the students could choose to take a final exam isochronic to the final moodle course test worth also 60 points (figure 2). One week prior to the final exam the students had to sign whether they wanted to be assessed based on their moodle results or take the final exam. Students found this advantageous because they could make their choice the last minute depending on their grade points until the time of the final exam. To prevent students from stopping to work in the middle of the semester most of the points were assigned in the last 3 weeks before final exam (60 points) or final moodle exam (10 points). The final exam counts for all students transferring in the middle of the semester, repeating students and those coming from different study subjects without access to present hours. Presence time was 1 day, 4 hours/week. HTW regulation allows for 20% e-Learning in a presence course, therefore the blended learning concept applies well.

3. Example 1: Results of a problem on phase diagrams in final exam

In summer semester 2015 the moodle course was still a voluntary “add-on”. In winter semester 2015 first activities counted for extra grade points and were compulsory to access the final exam. For both semesters the same problem on phase diagrams was given to students in the final exam. This problem aimed at solving practical problems regarding microstructure and the correct use of phase diagrams. Similar problems were given to the students in winter semester 2015 after studying the theory at home, whereas in summer semester phase diagrams was taught in class. In the final exam students scored 43% averagely of the phase diagram related problem in SS2015 where no inverted classroom scenario was applied and 68% averagely in SS2015/16 where phase diagrams was taught using the inverted classroom approach (figure 3).

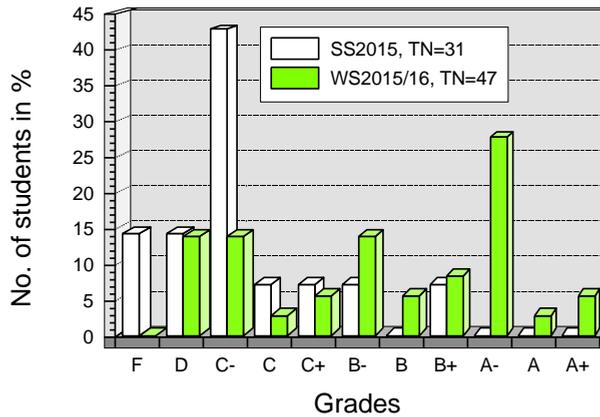


Figure 3. Results of compulsory problem on phase diagrams in final exam, left SS2015 (front teaching), right WS15/16 (inverted classroom). Purposely for reason of comparison the problem was the same in both semester.

Whether students in summer 2016 had better natural abilities or studied better could not be evaluated. However, results showed clearly that students had a much better understanding how to practically work with phase diagrams compared the previous semester (figure 3).

4. Example 2: Comparing course results obtained via final exam and cumulative moodle course assessment

Final grades in material science of winter semester 2015/16, with a final exam in the end of the semester as means of assessment, were compared to grades students achieved in the cumulative moodle course of summer semester 2016. Prior to this assessment students had to sign a form that their grade will be calculated from their results throughout the semester.

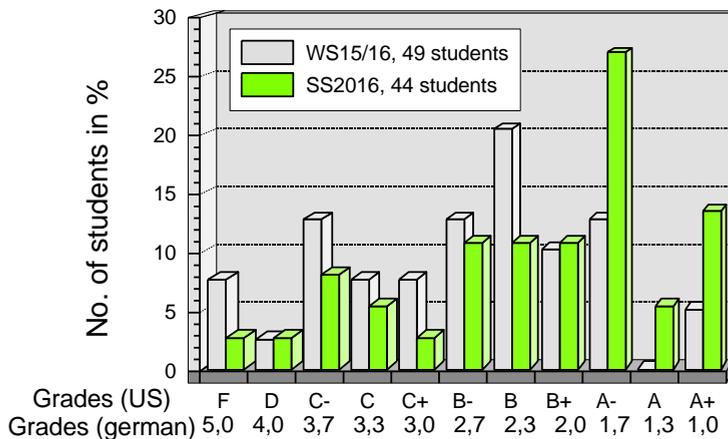


Figure 4. Results of compulsory final online exam in material science, left WS15/16, right SS2016

Avaragely students scored 39 (C+) out of 60 possible points in 2015/16 and 43 (B) (in 2016 (figure 4). On first sight this does not count for massive improvement, but the median differs lot more: 43.5 (B) in 2015 and 49 (A-) in 2016. Still, most important is the grade distribution: The moodle course assessment offers more students access to good grades, such as A- to A+ compared to the course assessment via final exam. Moreover, students with migration background scored higher and achieved better results than students belonging to the same group the previous semesters.

5. Evaluation of the moodle course concept

In summer semester 2016 44 out of 52 students chose the course assessment via cumulative moodle activities. 2 students chose a final exam and 6 students were lost during the first semester. Grades divided into more than 25 single micro grades that are weighed and summed offers the lecturer to be less biased during grading: CSU (2015) and therefore students grades are more substantial.

5.1 Students`opinion

Students found lecture videos and micro modules as main source of the “inverted classroom concept” appealing because they are reusable with no regard to place and time. The possibility to repeat whole lectures as well as small parts helped to meet the individual learning velocity. They found homework very useful in terms of self organization and learning complicated scientific issues and getting to the bigger picture of material science. Some students did not like homework, because they were forced to study instead of just pushing the work load ahead of them. Still, the biggest advantage of this grading system was found to be the transparent level of points throughout the semester letting students directy know the grade they are achieving at the moment reassuring them of their learning skills. And even more important was the fact, that the studying time did not push towards the end of the semester, but was equally distributed in time throughout the course.

5.2 Teachers`opinion

Pro: Because during selfstudying students were very motivated to learn, they share their knowledge helping others and contributing to solving problems in class. The pleasant atmosphere in class enabled students to apply their knowledge solving even more complex material science problems. During the semester students were given more responsibility for their learning progress which encourages critical thinking: CSU (2015), Lord (2012); that results in deeper learning outcomes: Goto and Schneider (2010), Simon et al. (2010). It was fun teaching lively and critical students who were eager to enrich the material science class.

The depth of scientific knowledge with wich students responded in forums was very high. In addition their discussion skills with regard to scientific knowledge were enhanced.

At-risk students that might fail the course could be identified very early and lecturers have the possibility to accompany their further learning progress more closely and –if necessary– provide detailed guidance. The possibility to work in small groups during class enables the teacher to provide help at the exact level the students learning has progressed and immediately supporting those who did not meet the requirements for a specific topic. Because the assignment is clear and most of the moodle activities are available throughout the entire semester, unprepared students studied very well after the contact time and achieved good grades.

Students with migration background and language problems in class in general showed good to very good results in tests and assignment when they were given enough time to overcome their language problems. Because they had a chance to score high in this class we found that especially these students put a lot of effort into their studies. This reduced the diversity in learning outcome during the semester and enhanced homogeneity. Also, students who had to work or take care of family members could participate without knowledge loss, because the moodle course offers time and place independent studying.

Contra: Students who only want to pass the course might not work constantly towards the end of the course once they achieved 30 points. It takes effort to motivate this specific group. However, increasing the amount of points adding to the course towards the end prevents students from dropping out early.

The amount of time to prepare moodle activities necessary to generate a stand alone moodle course initially along with lecture films meeting different learning types and the needs of a diverse first year material science class is outrageously high. Also, the time spent on emails answering question, giving advice or organizing has raised in addition to the time that has to be spent with the daily design and correcting and commenting on assignments. To benefit from this new teaching method the workload of the lecturer does not double but honestly rather triples.

5. Conclusion

Inverted classroom scenarios based on micro lectures in material science and peer-to-peer lecture films were established and provided via moodle. The blended learning approach gives students the chance to cumulative add micro-grades via multiple activities that are summed to obtain the overall course grade. Improved learning outcomes are demonstrated in high quality class discussions and in better grades. The majority of students agreed on enhanced study skills when forced to study throughout the entire semester instead of learning intensely towards the end of the semester. Enthusiastic students were able to solve enhanced problems and contribute to many issues in more depth.

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Short Story in an ESL Freshman English Course: Bridging the Gap between language and literature

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Abstract

In recent years, the place of literature in language teaching has regained its impetus and the prominent role it plays in promoting linguistic, cultural, intellectual and academic benefits has been acknowledged. Nevertheless, the place of literature in language teaching context in Turkey is still approached to be an outside source to be assigned as extensive reading rather than to be a classroom worthy material to be utilized in class. This article describes a literature lesson at a Freshman English level and outlines the steps to be taken to implement language based activities to promote 'language awareness' and to foster 'meaning construction' and 'cultural awareness' in a process based classroom setting. The steps also show that ESL Freshman students have much to gain from literature when the text is explored through language based activities without losing the literary nature of literature.

Keywords: *Literature; Short story; English as a Second Language; Once Upon a Time; Freshman English; Turkey*

1. Introduction

Following a paradigm shift in the 1980s, many theoretical arguments have been made for the implementation of literary texts in ELT/ESL context (Brumfit and Carter 1986; Maley and Duff, 1990; Carter and McRae, 1996; Gilroy and Parkinson, 1997; Hall, 2005). Literary texts initiate personal response and imagination, enable readers to make connections through experiences, develop awareness for different perspectives and multiple levels of meanings (McKay, 1984, Carter and Michael, 1991, Appleman, 2009.). McRae (1991 /1997) in *Literature with a small 'l'* calls this shift, 'the fifth skill' and puts forth that the development of the fifth skill, the skill of 'thinking in English', is mostly neglected in second language acquisition. This is due in part to the broad use of referential texts and 'the fifth skill' could be incorporated through the use of representational, imaginative texts in the ELT context.

The implementation of literary or representational texts in the ELT/ESL context by means of language-based approaches gives learners a rare opportunity in which they can react, respond, question and construct meaning by putting pieces together in a predictable world of English classroom where finding the right information and transferring it gets an applaud until the next 'wrong' answer. Carter (1996) advocates language based approaches to be 'essentially integrative' and sees the publication of *Reading Between the Lines* (1984) by

McRae and Boardman as the milestone in the integration of language and literary study because they propose approaches to literary texts from lower to higher levels contrary to the conventional belief that only advanced level learners should be engaged with literary texts. Gajdusek (1988) points out that it is prominent to have higher levels of reading and writing but not enough to survive in academic settings; thus, when presented with language based and student centered approaches, literary texts can facilitate improvement in the skills of higher thinking abilities and in particular 'the fifth skill: thinking in English requisite to survive in academic contexts, especially at the tertiary level..

Approaching *Literature with a small 'l'* requires a shift in methodology. The common misconception that literary texts could be used as an 'instrument to teach language structures or specific vocabulary for language manipulation' is prone to have a detrimental impact on learners (Carter and Long 1991, p. 2). If a text is approached this way, it is likely that the communicative impetus will simply be lost because of the devotion to mechanical aspects of the language as 'The content becomes subordinate to the mechanics' (McRae 1991 /1997, p.5). Another misconception which could turn the class into a traditional information transfer language class is teachers' imposition that 'the background to the work, the author and particular literary conventions' need to be presented when literature is in play (Collie and Slater, S. 1999, p. 6). Instead of focusing on the 'knowledge about literature', 'knowledge of literature and language' should be 'the ultimate aim where

learners are provided with some analytical tools with which they can find a way into the text' (Carter and Long 1991, p. 4) and thus construct meaning through student-centered language-based activities while promoting communicative competence and enhance language learning. With this broad rationale in mind this, it is the aim of this paper to outline the guidelines for the activities designed teaching a short story in a Freshman English ESL context. The two broad questions to be addressed are: what kind of classroom activities may contribute to 'language awareness' and could be implemented to promote 'meaning construction' and 'cultural awareness' ?

2. The Place of Literature in ESL

Widdowson (1983) in an interview in ELT journal explains the differentiating feature of literature which underpins the preliminary basis for implementing literary texts in ELT context: '... it is representative of a new reality' and one has to find evidence in the process of making sense, which is not required when reading 'conventional discourse'. Gajdusek (1988) concurs that in literary texts '... primary purpose is not just to convey information, but to involve the reader in direct experience...' and 'the techniques for contextualization, for explicitly providing background and signaling relationships-clues to meaning-are different; ... they are more consistently implicit than explicit' (p.229). Thus, on the

learner's side, reading literature is a procedural task where the evidence needs to be put together to decipher the context and construct meaning rather than following the frameworks of conventional reading process. McRae (1996) expounds a similar view when differentiating between the referential and representational materials. In the latter 'the rules are questioned, played around with, and put to different uses as part of that ongoing process of language acquisition' (p.17). For McRae, representational materials provide 'knowledge about language' and allow for the 'necessity of imaginative engagement' which are paramount in the language awareness process, constructing the bridge between native and target language when a learner goes beyond the application of rules and seeing language learning as an exercise (*ibid.*).

Apart from the discourse related aspects of literary texts, linguistic features; 'variety of language' and differentiating features of language used in literary texts are other aspects where learners can build language awareness and start questioning. Short and Candlin (1989) propose that 'Contrary to much received opinion, it is difficult to make a linguistic distinction between literature and other kinds of language' (p. 201) because any particular deviant feature of language could also exist in a corpus of non-literary texts (Short, 1986). Lazar (1993) sees the variety of language and style in literary texts to be an induction

to build language awareness through investigation where learners ‘become aware of specific stylistic effects’ and this helps them to interpret what is achieved through departing a form and discover the underlying meaning’ (p.19). Therefore, language variety in literary texts is argued to trigger ‘questioning’ and ‘making intelligent guesses’ thus initiating the construction of meaning (Lazar, 1993, Parkinson and Thomas, 2000). Still, the teacher needs to select the level and targeted skill appropriate texts especially in the lower levels.

On a broader scale, literature just like other representational texts is ‘authentic’ material, which is not molded for the specific purpose of language teaching. Language learners are exposed to language intended for native speakers and become familiarized to different meaning construction, linguistic uses and conventions (Collie, J and Slater, S. 1999). It provides personal involvement, personal growth and a motivational reinforcement pushing the learner to go beyond the boundaries of the mechanical aspects of language learning when the text is not approached ‘efferently’ but in a manner that forms an ‘aesthetic interaction between the reader and the text’ (McKay, 1984, p.192). The language learner’s discovery that language is not only a rule-based system but also a socio-semantic system creates different demands on the learner as information transfer would not suffice to construct meaning and learners are required to apply their knowledge of the world, life experiences and imagination in this new context making inferences and interpretations, building hypothesis while looking for evidence to support them. McRae (1996) states that ‘as soon as language begins to mean, it begins to expand its meaning, to make demands on its users... and questions of interpretation, of shades of meaning, of reaction and response’ follows (p.19). ‘Language’ itself requires ‘a more representational approach to teaching and learning’ (*ibid.*) and this is when it ‘begins to mean’, thus, the earlier a learner is exposed to such materials, the earlier it ceases to be a ruled-based system and becomes ‘language’.

3. Background to Class Implementation

Most language learners at Istanbul Sehir University receive a one-year English Preparatory School instruction and are required to pass the IELTS with an overall score of 5.5 to be able to move to freshman year. During one-year English Preparatory School instruction, learners mostly encounter representational or literary texts tailored for the specific purpose of language teaching in their textbooks and graded readers as extensive readings at the discretion of the teachers. The Freshman English Program curriculum aims at equipping students not only with higher level of English skills but also developing higher order

thinking skills to be able to cope with the academic requirements. With this aim in mind, classroom materials designed in a content-based syllabus include a blend of literary texts;

short stories and novels, representational texts; speeches, editorials and referential texts; academic texts. Under one of the themes, learners study two short stories ‘Once Upon a Time’ by Nadine Gordimer and ‘Doll’s House’ by Katrine Mansfield in a two- week period, the instruction of the former being the focus of this paper.

‘Once Upon a Time’ by Nadie Gordimer consists of two parts; a non-fictional opening and a fictional part resembling a fairy tale. The initial part is a first person narrative and explains why the narrator changes her/his mind and decides to write a children’s story after going through an experience thinking someone; (here ‘the other’) has broken into her/his house. The second part depicts the increasing fear of a white family placed in a gated community in the suburbs as the riots take place in the city. The fear of ‘the other’ and the need to keep them away leads the family to put up fences and walls which eventually ends up killing their little boy as he plays in the razor wires up on the walls. It touches upon the issues of fear of ‘the other’, discrimination, social classes, social hierarchy and a severe criticism of the remnants and collective memory of the Apartheid era.

3. Implementation in Class

3.1 Lesson 1

The ‘activity’ is ‘where students actively participate in making the text mean’ (Carter 1996, p. 3). Actively processing the text is different from completing tasks to ‘comprehend’ it. In this lesson, learners engage with the text through constructing meaning following a language-based approach, by means of ‘open ended high order questions’, a ‘targeted cloze procedure’ and ‘the movement of the text’. Questioning’ is a text-processing activity commonly used in language classes; however majority of questions involve ‘the lowest level of mental capacity’ which ‘goes against the most fundamental characteristics of texts as linguistic events’ (Van Peer, 1989, p. 276). Carter and Long (1991) advocate the

use of ‘ “high-order, open questions” involving the learner’s own responses, inferences, knowledge and experience of the world’ to generate meaning. These questions ‘rarely have a right answer’ (p.36) what will be used in this and the following lessons to involve learners’ own responses. The second activity directs the learners’ attention to the change of style and the language in the beginning of the story. The last two lines of ‘one line paragraphs’ were designed as a ‘cloze-text activity’, which aims at ‘ confronting learners with texts that are open in the material sense of the world and have them reconstruct the text... on the basis of cohesion’ (Van Pier, 1989, p. 281). With the last activity, learners trace the movement in the text and underline some of the verbs in paragraphs five and seven. This might give the learners a confidence in understanding how the text works and

following 'I' in 'present and past', start constructing meaning on the change of attitude and 'point of view' through syntax and lexis recognition and awareness. If we look at the first section of the story, questions such as 'What can you tell about 'I'?', 'Do you think 'I' is a male or a female?', 'Think of some adjectives to describe 'I'. Which of the following adjectives ... (McRae and Vethamani, 1999) 'Why do you think the word "ought" is in the quotation marks? What do you think this tells us about how 'I' feel?', 'Do you think 'I' is right to feel/ think this way?' aim at involving learners' own responses, knowledge and experience of the world which would trigger a higher level of cognitive skills and help construct meaning regarding the point of view of 'I'. In the beginning of the story, one - line paragraphs are central to understanding the underlying premise of the story. Learners are asked to fill in two blanks reconstructing the question and the answer posed in the story by 'I' Comparisons of the reconstructed and the original text will facilitate another discussion on the choices of the words and 'point of view' and help elicit the theme of 'fear' analyzing the following contrasts: 'question & answer', 'subconscious & conscious level', 'a voice & a sound'. This activity instigates 'questioning' and 'making intelligent guesses' thus initiating the construction of meaning (Lazar 1993, Parkinson and Thomas, 2000).

In 'Once Upon a Time', verbs move from past, past continuous and to present in recurring order in the first section and learners trace this movement and make a list of the verbs in past and present. Questions such as 'Are these verbs mostly negative or positive? Are any of the verbs that you don't know are positive or negative?', 'How does 'I' feel about the past and about the present?', 'Would it be different if we eliminated the sentences in 'present tense?'' would be a starting point to work on the first binary in the text: 'past and present'. Comparison of some of the verbs in past '*murdered, guarded, strangled, dismissed, threatened*' with the ones in present '*surrounds, trembles, detaches, falls, shifts*' could open up a new dimension on the idea of 'point of view' and the change in 'point of view' from past to present. The lesson ends with a prediction activity: 'What do you think this bed story will be about?' which leads learners to make intelligent guesses elaborating more on the movement in 'point of view'.

3.2 Lesson 2

Lesson two starts with the question 'How is this section similar to the first one?' And how is it different?'. Here some of the features of literary texts such as 'setting, plot and characters' would be elicited through the comparison with the nonfictional opening of the story. The differences and the ideas learners propose through this comparison will be revisited at the end of the story. In the prereading activity, a basic comprehension question: 'How many people are mentioned in this passage?' followed by 'high order-open

questions' (Carter and Long 1991) such as 'What can you tell about where they live?' 'What does this tell us about the people in the story?' would help form a context of meaning, a lack of which would lead to difficulties in understanding the text and therefore

should be established in the beginning of the text. Picking out 'binaries or contrasts' follows the pre-reading activity. Using 'binaries or contrasts' as a first activity gives learners a starting point and an opportunity to say something about the text focusing on what they know rather than what they don't know and helps develop confidence in reading as well as constructing meaning through implicit 'relationships-clues'. (Gajdusek 1988, p.

229). This activity would provide the 'necessity of imaginative engagement' (McRae, 1996, p.17); delving into the new world created in the story that would foster the 'exploration and discovery of key concepts required' to compensate for the lack of explicit contextualization. (Gajdusek, 1988, p. 231). If we return to the story, learners only focus on the first paragraph initially and pick out the binaries related to the concepts of 'danger and security' making a list of words associated with these concepts under each heading. The next activity moves them forward to identify other contrasts in the text in terms of 'People, Places, Mood, Positive and Negative' and directing students to identify the main contrasts in the story. Binaries in relation to people also lead to a more detailed analysis on the

concept of 'point of view'. Questions such as 'What adjectives are used for...?', 'Who do you think chose the adjectives?' instigate questioning on the 'choice of adjectives' and would guide students to a better analysis of the characters' and /or the author's point of view. (McRae and Vethamani 1999) The choice of adjectives for the maid and the gardener with adverbs 'absolutely trustworthy', 'highly recommended' and for the husband's mother 'wise old' witch would be connected to the concept of 'point and view' and lead to questioning why no adjectives are used to describe the main characters: the husband and the wife. Focusing on the maid and the idea of 'advice' in the story, learners would trace the changes in the family's life and would answer if they sympathize with the husband or wife or with someone else in the story. The lesson ends with the questions 'Do you think the husband and the wife and their little boy are safe now?' and 'What do you think will happen next?' allowing the learners to reconstruct the text; the ending of the story in pairs or groups and reporting to the class how they would finish the story.

3.3 Lesson 3

The last lesson focuses on the issues raised in the story and requires the learners to answer 'what the story might have meant' to create cultural awareness and a recognition in the universality of the issues making references to their own lives. The pre-Reading task is designed to elicit the stylistic features in the story resembling a fairy tale story. Students discuss in groups and pick the most appropriate title for the story and justify their reasons

referring to evidences in the story ‘making intelligent guesses’ thus initiating the construction of meaning (Lazar 1993, Parkinson and Thomas, 2000). After the students are presented the real title ‘Once Upon a Time’, they continue working in groups and pinpoint some of the features in this story that are similar to a fairy tale and propose their personal responses on why the author might have chosen this title and particular style of storytelling.

Drawing a mental picture of these particular societies (the society ‘I’ and the other characters live in) and their comparisons follow the initial activity and this aims at encouraging students to postulate some hypothesis on the author and her point of view and whether it is different than ‘I’ ‘s point of view. Through some ‘high order-open questions’ (Carter and Long, 1991), students are directed to question ‘who is responsible’ for what happened to the little boy, whether their sympathy for any characters have changed, whether it is a recent story, in which country this story might have taken place and if the society they live in is any different. These kind of questions ‘make demands’ on language users and interpretation, of shades of meaning, of reaction and response’ follows (McRae,

1996, p. 19). In the last activity learners are presented with a list of ‘moral lessons’ that this story might contain; they are asked to pick the most appropriate one or if they don’t agree with the morals presented, construct their own morals justifying their reasons. This last activity should lead to a class discussion, as the learners defend their own reconstruction of the story in one sentence and decide which of the following issues seems to be central to the meaning of the story: fear of ‘the other’, discrimination, social classes, social hierarchy.

4. Conclusion

Implementing literary texts in the ESL /EFL context, in our case; in an ESL Freshman English Program could facilitate improvement in the skills of higher thinking abilities, a lack of which puts overwhelming demands on the learners in academic contexts. Introduction to literary texts by means of student-centered and language-based activities would reinforce promoting communicative competence, as students need to ‘find a way into the text’ (Carter and Long, 1991, p. 4) in a context where comprehension would not suffice and the approach to language as a rule-based system need to shift into ‘language’ through meaning construction. In the instruction of the short story ‘Once Upon a Time’ by Nadine Gordimer, varied language based activities are designed to introduce the concept of ‘point of view’ and create an awareness towards the function of the text; thus, create cultural awareness on some of the universal issues depicted in the story. Regardless of the historical context or place, students are guided towards using their knowledge of the world and need to engage with the text in an imaginative way, react, respond and ‘make the text mean’.

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A new approach to the introductory teaching of Computing and IT at the Open University UK

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Abstract

The Open University of the United Kingdom is a distance-teaching university with no entrance requirements; modules are available world wide. This paper presents a novel approach to the teaching of introductory Computing and IT at the University (level 1 / first-year bachelor's degree). The new module covers: digitization; elementary programming; fixed and mobile communication networks; webpage design; the Internet of Things; and socio-technological aspects of ICT (such as the 'information society', gender issues, health care, and the 'digital divide'). The rationale and structure of the course are presented, with an outline of the content and assessment strategy. Major aims of the new module are: to improve skills development; redress the current gender imbalance in the subject area at the Open University; and improve general completion and progression rates. The module also makes widespread use of on-line activities and forums in support of learning and the development of a sense of a 'community at a distance'.

Keywords: HE pedagogy; computing; ICT; communication networks; programming; information society.

1. Introduction

The Open University of the United Kingdom is a distance-teaching university with no entrance requirements – which creates challenges in developing C&IT modules as there is a need to cater for a huge range of students (Bissell, 2011). Modules are available worldwide. This paper discusses a new, level 1 course, TM111 Introduction to Computing and Information Technology I, to be first presented by the Science, Technology, Engineering and Mathematics (STEM) Faculty in autumn 2017.

2. Structure and rationale of the module

TM111 provides a broad introduction to Computing and Information Technology concepts, principles, and theories, in the continuing tradition of OU teaching in this field (Bissell & Williams, 2008). The module is designed to appeal to a wide audience, especially to women who are under-represented in this sector of UK HE.

There are three blocks of study, guided by an online study calendar and supported by both printed and online materials, online audio-visual resources, and module forums (Kear, 2001, 2010; Kear *et al*, 2016). The module will be followed for most students by the module TM112 *Introduction to Computing and Information Technology II*. A quiz is used before the start of TM111 to help students assess their readiness for study. Major aims of the new module are (i) to improve skills development, particularly in the area of coding and software development, but also as far as general study competences are concerned (Havergal, 2015) ; and (ii) to improve general completion and progression rates.

2.1. Block 1

Block 1 of TM111 provides an introduction to the role of Computing and Information Technology in everyday life. The block begins with an induction and orientation period of two weeks during which students learn basic ‘studentship’ skills such as: finding their way around the module resources; visiting the online library; learning what is expected of them in terms of engagement and completion of assessments; and what they can expect of the University in terms of support during their studies. The first two weeks also explore the wide-ranging uses of computing and IT systems in contemporary society, keeping safe online, and key milestones in the development of computers. During the Block students explore important computing and IT concepts relating to their everyday life including:

- The processes by which sound and images in the real world are captured stored, and shared with peers and the wider world through social networking sites.
- How data about people, products and services is stored, managed, and used in online databases – for example, by Amazon the online retailer – and how ‘big data’ datasets are analysed and exploited.
- The importance of good design in human-computer interaction (HCI) and the importance of usability and accessibility.
- The basic construction of webpages, including CSS and HTML5.
- The historical development of computers (Figure 1).

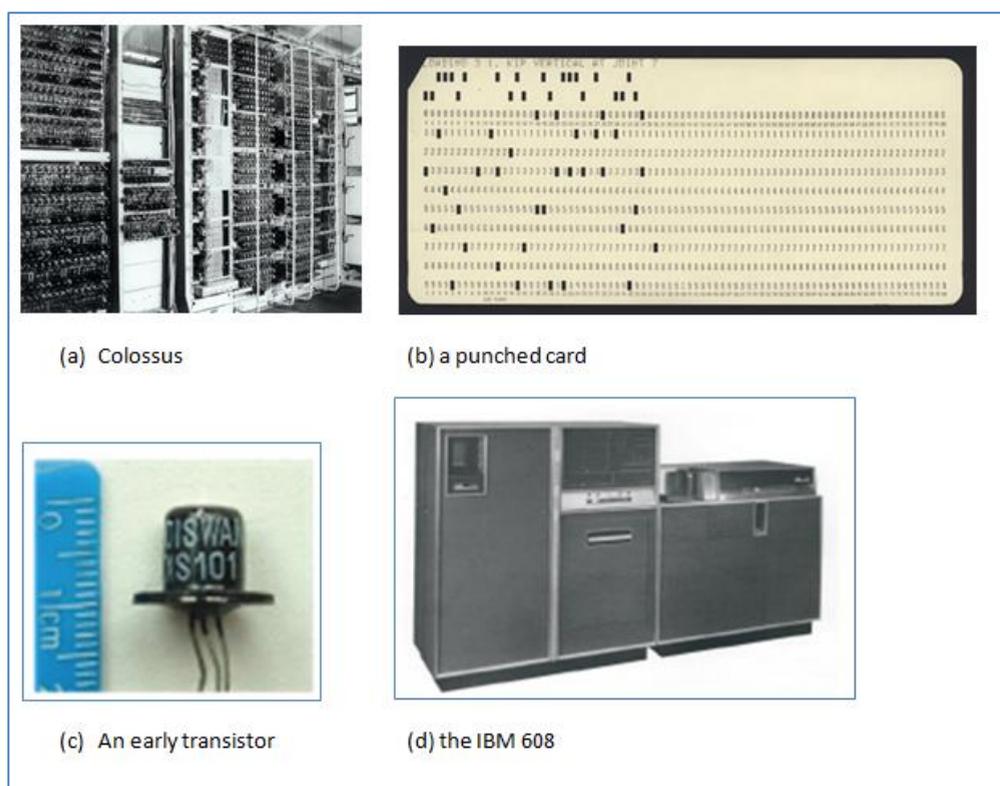


Figure 1. Examples of the historical development of computing

Other important communication and study skills (still inadequate in much of HE), such as note-making and good academic practice, are introduced and taught in context during this block, along with information literacy such as search skills and library skills. Numeracy – working with number bases, for example, SI prefixes, and exponentials – is also taught.

2.2. Block 2

Block 2 focuses on implementing solutions to simple problems in a visual programming environment and the development of elementary algorithmic thinking. Students are introduced to the *Scratch* programming environment (Otts, undated), customized for OU students, and they explore a variety of programming techniques, such as sequencing, iteration and selection. They are encouraged to be creative in producing their own ‘sprites’ and backgrounds within the environment to develop simple animations and simulations. The activities highlight fun and enjoyment in programming, whilst developing the necessary skills and knowledge necessary for level 1 university study, in the context of employability (something highlighted throughout the module).

Scratch was chosen as a simple graphical approach to elementary programming skills, in order to avoid the problems beginning students have demonstrated in the past with more conventional languages, particularly with pseudocode or similar. (Note, however, that the follow-up module, TM112, will use *Python* (Keopke, 2010), to broaden and deepen students’ understanding of coding and software development.) There is an ongoing debate about the ‘best’ way to teach programming. TM111 opts for the visual way in order to provide a ‘gentle’ introduction to programming skills for our extremely diverse student cohort. This also helps to raise students’ awareness of the strengths and weaknesses of different types of programming, addresses an all too common lack of engagement with programming at level 1 which means that a significant number currently students struggle at level 2.

Figure 2 shows one of the earliest TM111 activities in *Scratch*, causing a sprite to open and close its eyes, while Figure 3 is an elementary numerical programming example.

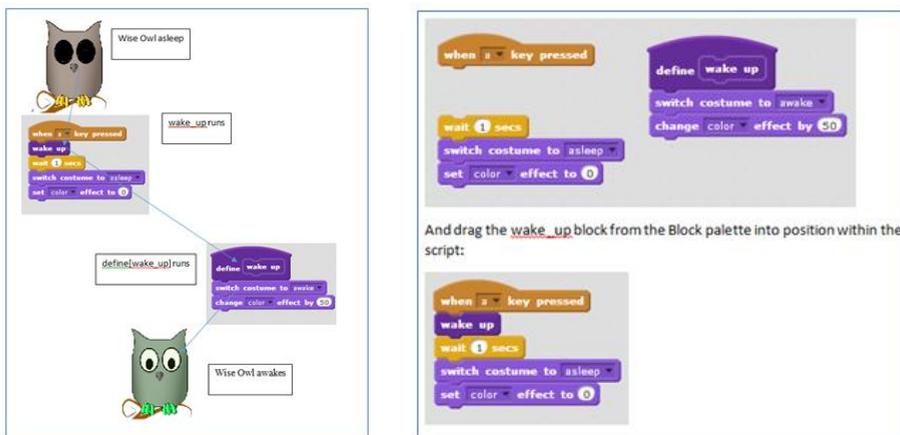


Figure 2. Programming a sprite by dragging function blocks into place; the owl sprite is part of the standard Scratch specification, and will be modified for adult learners.

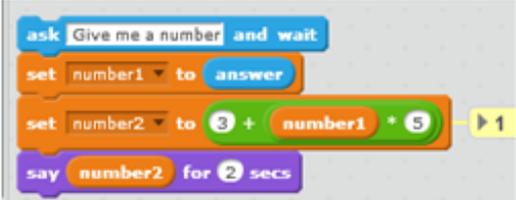
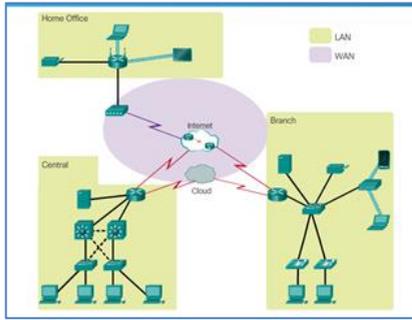
<p>Now try this:</p>  <p>Again try different user inputs.</p>	<p>When block 1 is run</p> <ul style="list-style-type: none"> • The value of number1 is used as input to the <code>[]*[]</code> block which reports the result of multiplying the user's number by 5. • Then this result is used as input to the <code>[]+[]</code> block which reports the result of adding 3 to this latter result • And then the <code>set[]to[]</code> block sets number2's value to this result. <p>So if the user enters 15 then number2 is set to $3+(15 \times 5)$ i.e. to 78.</p>
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Figure 3. A numerical programming example in Scratch

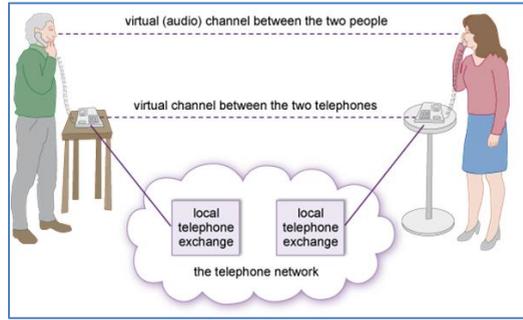
2.3. Block 3

This final Block deals with communications networks and introduces students to key concepts and technologies underpinning them. The first three Parts of the block explore transmission media, the electromagnetic spectrum, the structure and operation of the internet, and introduces wireless communication. Students gain an understanding of different types of wireless communication including mobile telephony, WiFi, Bluetooth, ZigBee and RFID.

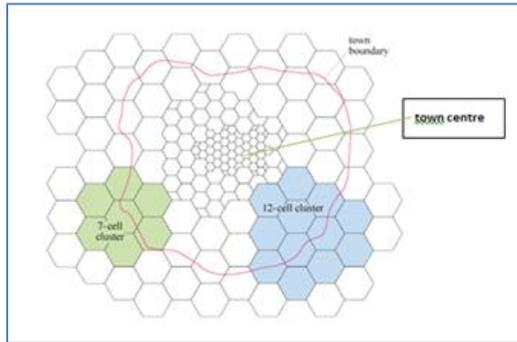
Figure 4 indicates the scope of these first three Parts of the Block. Part (a) shows how LANs and WANs are linked; part (b) illustrates the notion of layering; part (c) is a classic cell topology; and part (d) a typical WiFi infrastructure network.



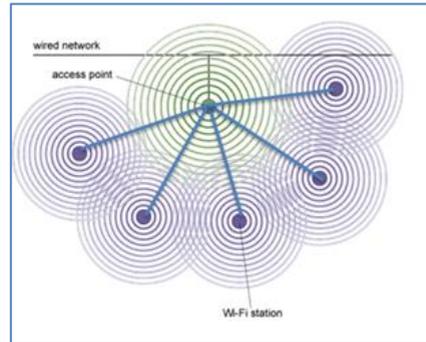
(a) network structure



(b) peer-to-peer layers



(b) a cellular system



(d) a WiFi network

Figure 4. Examples of communication systems covered in Block 3

The final three parts discuss the Internet of Things (IoT), on-line communication, and issues of security, gender, health care, democracy, and ‘north/south divides’ in ICT (Graham, 2011).

The material on IoT covers topics such as home automation (including coping with signal obstructions), energy harvesting, low-power WANs, and the future of the IoT. The *Online Communication* Part looks at a wide range of asynchronous and synchronous activities, such as forums, group communications, online communities, the social web (*Flickr*, *YouTube*, *Pinterest*, etc), and wikis. A subsection is devoted to social networking products, with a description of their emergence, and a consideration of the similarities and differences between *Facebook*, *LinkedIn*, and *Twitter*. The important issues (positive and negative) of social networking are discussed, as are technological and ergonomic aspects and the notions of social presence and awareness. The final Part of the Block, *The networked Society*, addresses Government and the State, biometrics, DNA information, and networking for health. Three audio interviews are included with researchers who have investigated: the impact of mobile phone use on the lives of socially excluded young women; projects

exploiting digital technology to benefit schools in Nepal; and the use of ICTs to for personal health monitoring.

2.4 On-line activities throughout the course

Peer review and group work skills are promoted throughout the module through on-line, forum-based activities, including those run by Associate Lecturers for their individual tutor groups of around 25 students. The in-house environment *OpenStudio* is exploited for online file sharing and other applications (Thomas *et al*, 2016). The module team aims to create a strong sense of a learning community, particularly in Block 2 where there are specific on-line activities to support the teaching of programming and problem-solving.

3. Assessment

A wide range of assessment is employed (Heap *et al*, 2004). Continuous assessment for the module consists of three tutor-marked assignments (TMAs) marked by Associate Lecturers, and three interactive computer-marked assignments, iCMAs. The TMAs provide an opportunity for personalised tutor feedback and assist a student's progression to the following module TM112. The iCMAs consist mainly of short-answer and multiple-choice questions to check knowledge and understanding. The cut-off date for the first iCMA (iCMA01) occurs early in the module, to ensure that students are engaging with the module in the early stages so that advice can be provided. The second and third iCMAs take place midway through blocks 2 and 3 respectively. Assignment iCMA02 will test numeracy, problem-solving and programming, and iCMA03 further tests knowledge of networks and numeracy associated with networks. Students will count their best two iCMA scores towards their final score. TMAs occur at the end of each block of study and assess the content covered in the block. Skills development will be assessed in TMAs – for example, skills in communication in writing will be developed in Block 1 and extended in Block 3.

4. Conclusion

The new UK Open University module TM111 *Introduction to Computing and Information Technology I* adopts a very broad approach to the introduction to the subject area. Learning materials include a coverage of theory, technology, practical skills development, and the wider socio-technological issues in the ICT and computing field. Students have traditionally found many of these concepts – particularly mathematical and programming topics – problematic, so great care has been devoted to the choice of software environment, the mix of methods (from print to animations and computer-aided learning packages) and to the staged development of skills throughout the course. Once completed, the course is excellent preparation for the more advanced modules offered by the University at higher levels of a bachelor's degree.

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Autonomy-supportive learning with VaKE (Values and Knowledge Education) in teacher education. Fostering empathy and cognitive complexity.

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Abstract

The aim of this study is to examine enhanced autonomy-supportive teaching with VaKE (Values and Knowledge Education) in teacher education. VaKE is a constructivist teaching and learning approach which combines values and knowledge education, providing possibilities for autonomous learning. A quasi-experiment was applied with N = 43 pre-service teachers in an Austrian university of teacher education. The standard VaKE was compared with VaKE focusing on enhanced autonomy-supportive teaching by providing option choices. Dependent variables were the capacity to take the perspective of others (empathy) and the capacity to deal adequately with multiple sources of knowledge (cognitive complexity). The results indicate that empathy and cognitive complexity can be increased when providing enhanced cognitive autonomy support with VaKE. The main conclusion is that pre-service teachers can benefit in their moral as well as knowledge-related capacities when learning according to VaKE with provided option choices.

Keywords: *VaKE; teacher education; autonomy-supportive teaching; empathy; cognitive complexity.*

1. Introduction

Educational psychologists and teachers agree that autonomy-supportive teaching contexts enhance student motivation resulting in improved performance and learning. Autonomy-supportive teaching has gained increased attention in teacher education in the last years (e.g., Meeus et al., 2008) aiming to foster pre-service teachers' professional capacities. One way to implement autonomy-supportive teaching consists in providing opportunities to make personal choices. The didactical approach *VaKE* (Values *and* Knowledge Education; Patry et al., 2013), which combines moral education through dilemma discussion (Lind, 2016) and knowledge construction through inquiry learning (Reitinger et al., 2016), promotes autonomous learning based on constructivist learning principles by offering opportunities for personal choices. The aim of the study is to examine *VaKE* with respect to its potential to foster pre-service teachers' capacities (a) to take the perspective of others (empathy), and (b) to distinguish, integrate and apply multiple pieces of knowledge (cognitive complexity). Both capacities refer to essential goals in teacher education (Tettegah & Anderson, 2007; Bullough et al., 2016).

2. Autonomy-supportive teaching with VaKE (Values and Knowledge Education)

VaKE is a constructivist approach aiming to promote moral judgment (Rest et al., 2000) and the acquisition of deep knowledge (Piaget, 1985). Constructivist learning contexts are characterized by support for the learner's autonomy. According to the self-determination theory (Deci & Ryan, 2008), autonomy-supportive teaching promotes intrinsic motivation and leads to improved learning. An individual's sense of autonomy represents a feeling of full volition and "choicefulness" depending on one's values and interests (Deci & Ryan, 2008). Autonomy is best supported through providing the opportunity for choices. *VaKE* consists of eleven steps, each of which provides opportunities to make choices (see Tab. 1).

A *VaKE* unit starts with the introduction of a content-related moral dilemma, which is designed to trigger a moral question ("What should be done, and why?") as well as knowledge-related questions ("What do I need to know to come to a satisfying solution?"). The learners discuss about the values which they deem important in the dilemma (step 1). Subsequently they reflect upon their decision and write down their own argument (step 2). In small groups they discuss the dilemma addressing their individual moral point of view (step 3). The results of the discussions are exchanged and all open questions regarding missing knowledge are collected. Learners decide how to organize the following information search and the final learning product (e.g., poster) which will be presented later (step 4). Then they organize themselves in groups to search for the individually relevant missing knowledge using different sources of knowledge (step 5). They exchange their

acquired knowledge and discuss it so that all learners have the same level of knowledge (step 6). After that the dilemma discussions in small groups are continued. The learners integrate their individually relevant knowledge into their moral judgment (step 7). In a general discussion the results of the dilemma discussions are presented and all learners discuss their favored arguments (step 8). If there are still open questions, the steps 4 to 8 can be repeated once again (step 9). In the final synthesis the learners present the proposed problem solutions (learning product) of the whole group (step 10). Finally, in the generalization, the learners deal with similar issues they consider important to broaden the perspective (step 11).

Table 1: Standard steps in VaKE

<p>(1) <i>Introducing the dilemma</i>: Which values are at stake?</p> <p>(2) <i>First decision</i>: Who is in favor, who against?</p> <p>(3) <i>First arguments (dilemma discussion)</i>: Why are you in favor, why against? Do we agree with each other?</p> <p>(4) <i>Exchange experience and missing information</i>: Exchange of arguments; what more do I need to know to be able to argue further?</p> <p>(5) <i>Looking for evidence</i>: Get the information, using any source available!</p> <p>(6) <i>Exchange of information</i>: Present the information! Is the information sufficient?</p> <p>(7) <i>Second arguments (dilemma discussion)</i>: Why are you in favor, why against?</p> <p>(8) <i>Synthesis of information</i>: Present your conclusions!</p> <p>(9) <i>Repeat 4 through 8 if necessary</i></p> <p>(10) <i>General synthesis</i>: Closing the sequence capitalizing on the whole process!</p> <p>(11) <i>Generalization</i>: Discussion about other related topics</p>

Source: Adapted from Patry et al. (2013, p. 567).

VaKE includes all different ways of autonomy support which can be provided in the classroom (Stefanou et al. 2004), namely organizational (e.g., learners decide about the organization of the information search and the learning product), procedural (e.g., learners choose the sources of knowledge), and cognitive autonomy support (e.g., learners generate their own solutions to the VaKE dilemma). Research has shown that cognitive autonomy support that allows the learners to control the initiation and regulation of their behavior in addition to providing option choices, enhances intrinsic motivation and subsequent learning most (e.g., Cordova & Lepper, 1996). Cognitive autonomy support in VaKE can be enhanced by providing option choices regarding the moral dilemma. Moral dilemmas which are meaningful to the learner evoke more empathy than less relevant ones (Skoe et al., 2002). According to Davis (1994), empathy consists of a cognitive (the ability of knowing another person's thoughts and feelings) and an affective component (the ability to imagine how another is thinking and feeling). It seems also reasonable to assume that dilemmas which are meaningful to the learner lead to intrinsic motivation and a more

intense engagement with multiple sources of knowledge resulting in improved cognitive complexity. Cognitive complexity can be enhanced through active practice in problem solving related to an actual role-taking experience and augmented by interactive changes with others (Sprinthall et al., 2000) which are key elements of a dilemma discussion in VaKE. Thus, the hypotheses are that VaKE with enhanced autonomy will support learning through providing option choices regarding the moral dilemma and hence will foster (a) empathy and (b) cognitive complexity to a greater extent compared to the standard VaKE.

2. Method

2.1. Participants and research design

The study was conducted in a university of teacher education in Austria with two classes (class 1: N = 20; five males; class 2: N = 23; five males; mean age: 22.8, range: 19.8 to 45.2 years). All participants gave informed consent to take part in the study. In a quasi-experiment with pretest (T1 after step 2 in VaKE) and posttest (T2, after the end of the VaKE unit) the experimental group (EG, class 1) learned according to VaKE providing the opportunity to choose between five content-related moral dilemmas (abortion, helping illegally refugees, drug abuse, planting gene-manipulated corn in Africa, reproductive cloning), while the control group (CG, class 2) learned according to the prototypical VaKE with a pre-defined randomly selected content-related moral dilemma (reproductive cloning). All dilemmas were designed following the criteria for good VaKE-dilemmas according to Weinberger et al. (2008). In the EG all persons decided to discuss the abortion dilemma. The intervention in each group lasted six units of 90 minutes according to the steps of VaKE.

2.2. Instruments

The first instrument was the Saarbrückener Persönlichkeitsfragebogen SPF (Paulus, 2009), a paper and pencil questionnaire assessing the cognitive and affective components of *empathy* on 5-point Likert-scales. Three subscales were assessed (Perspective Taking, Empathic Concern, and Fantasy). In order to examine convergent validity, empathy was also assessed with a second instrument which was an open-ended questionnaire (OEQ). The OEQ was also used to assess the level of *cognitive complexity*. It consists of two questions: 1) What should the protagonist of the dilemma do? 2) Why should the protagonist do that? In order to check the operationalization of the independent variable (manipulation check) a single question about the participants' interest in the dilemma was asked, to be answered on a 5-point Likert-scale. The participants responded to the three questionnaires at T1 and T2.

2.3. Analysis

Following Paulus' (2012) suggestion to improve test efficiency, an aggregated empathy score built from the three subscales of the SPF was used (reliability: Cronbach's Alpha = 0.81). The differences in the SPF-scores between EG and CG were analyzed using a repeated measures ANOVA. The answers to the second question of the OEQ were content-analyzed according to Mayring (2014). The categories for analyzing empathic responses were derived from Davis' (1994) assumption that empathy includes a cognitive component (perspective taking) and an affective component (empathic concern). The unit of analysis were text segments (e.g. sentences). All text units referring to another person's view were assigned to the category Perspective Taking. All text units mentioning other-oriented emotions were assigned to the category Empathic Concern. The categories for analyzing the level of cognitive complexity were derived from Streufert et al. (1987) who posit that cognitive complexity can be assessed along the three dimensions differentiation, discrimination and integration. In the current study only differentiation and discrimination were used since the data did not allow to analyze integration. Differentiation indicated the number of text units representing different concepts expressed by the same person. Text units representing different pieces of information about one concept were assigned to the category Discrimination. Interrater-reliability (Krippendorff's alpha) was satisfying (empathy: KALPHA = 0.83, cognitive complexity: KALPHA = 0.78). Based on the assumption that the best estimate of participants' responses to the latent variable is given by the responses of the participants to a composite variable (Walkey, 1997) all subsequent analyzes of the OEQ-results were done using a unit-weighted aggregated score for empathy, built from the two empathy scores, and for cognitive complexity, built from the two cognitive complexity scores. Statistical analyzes were calculated using ANOVAs with repeated measures and *t*-tests (post-hoc tests with Bonferroni-corrected alpha level).

3. Results

3.1. Manipulation check

A repeated measures ANOVA with the dependent variable interest in the dilemma, the between subjects factor group (EG vs. CG), and the within subjects factor time (T1 vs. T2) resulted in a significant interaction effect time by group ($F(1/41) = 8.59, p < 0.01, \eta^2 = 0.19$). Subsequent analysis of this effect indicate that interest increased in the EG ($t(19) = 3.11, p < 0.01, d = 0.6; M_{T1} = 4.00, SD = 0.79; M_{T2} = 4.47, SD = 0.71$) while there was no difference found in the CG ($t(22) = -1.31, n.s., d = -0.2; M_{T1} = 3.68, SD = 0.94; M_{T2} = 3.45, SD = 1.19$). The group main effect was significant ($F(1/41) = 6.02, p < 0.05, \eta^2 = 0.14$); the dilemma was of higher interest for the EG than for the CG. The time main effect was not significant ($F(1/41) = 1.04, n.s., \eta^2 = 0.03$). These results indicate that indeed the EG

students were more interested in the dilemma than those of the CG, and that the interest in the EG increased.

3.2. Testing of Hypothesis 1: Empathy

In view of the natural setting it was not possible to control for all the differences between the participants in both groups. However, the results of independent samples *t*-tests with Bonferroni corrected alpha level show no significant differences between the EG and CG at T1 for the SPF-score ($t(41) = 0.32$, *n.s.*, $d = 0.1$) and for the OEQ-score for empathy ($t(41) = 1.26$, *n.s.*, $d = 0.4$). In order to determine differences between T1 and T2 a repeated measures ANOVA was calculated. Time (T1 vs. T2) and instruments (SPF vs. OEQ) were the within subject factors and group (EG vs. CG) the between subject factor. The interaction of time by instrument by group was significant with substantial variance accounted for ($F(1/41) = 14.36$, $p < 0.001$, part. $\eta^2 = 0.26$). Subsequent analyses of this effect using post-hoc *t*-tests indicate a significant gain of the SPF-score in the EG ($t(19) = -2.48$, $p < 0.05$, $d = 0.6$) from $M_{T1} = 3.69$ ($SD = 0.44$) to $M_{T2} = 3.98$ ($SD = 0.56$) and a significant gain of the OEQ-score ($t(19) = -4.40$, $p < 0.001$, $d = 1.2$) from $M_{T1} = 3.15$ ($SD = 1.34$) to $M_{T2} = 5.30$ ($SD = 2.17$), while no significant gain was found in the CG for the SPF-score ($t(22) = -0.61$, *n.s.*, $d = 0.1$; $M_{T1} = 3.64$, $SD = 0.49$; $M_{T2} = 3.69$, $SD = 0.55$), and the OEQ-score respectively ($t(22) = 0.91$, *n.s.*, $d = -0.2$; $M_{T1} = 2.65$, $SD = 1.23$; $M_{T2} = 2.35$, $SD = 1.64$). All other interactions and main effects were found to be significant but the effects are already accounted for by the three-way interaction. The results support hypothesis 1.

3.3. Testing of Hypothesis 2: Cognitive Complexity

The *t*-test for independent samples shows a marginally significant difference in the cognitive complexity score between EG and CG at T1, with a slight advantage for the EG ($t(41) = 2.02$, $p = 0.054$, $d = 0.6$; $M_{EG} = 3.75$, $SD = 1.77$; $M_{CG} = 2.86$, $SD = 0.86$). A repeated measures ANOVA was performed to examine changes in the cognitive complexity score between the two groups. The dependent variable was the cognitive complexity score. Time (T1 vs. T2) was the within subject factor and group (EG vs. CG) the between subject factor. The results show a significant interaction effect time by group ($F(1/41) = 10.27$, $p < 0.01$, part. $\eta^2 = 0.20$). Subsequent analysis of this effect using post-hoc *t*-tests show a significant increase of the cognitive complexity score for the EG ($t(19) = -4.98$, $p < 0.001$, $d = 1.23$) from $M_{T1} = 3.75$ ($SD = 1.77$) to $M_{T2} = 6.47$ ($SD = 2.59$), while in the CG no significant increase was found ($t(22) = -1.88$; *n.s.*, $d = 0.45$; $M_{T1} = 2.87$, $SD = 0.86$; $M_{T2} = 3.54$, $SD = 1.90$). The main effect time was found to be significant ($F(1/41) = 28.36$, $p < 0.001$, part. $\eta^2 = 0.40$) indicating that the cognitive complexity increased summarized across

both groups. The main effect group was significant ($F(1/41) = 16.29, p < 0.001$, part. $\eta^2 = 0.28$) revealing that the groups differed summarized across both measuring times. The results support hypothesis 2.

3. Discussion

Enhanced cognitive autonomy support through providing the opportunity to choose a moral dilemma increases the effectivity of VaKE: Pre-service teachers benefit more in their ability to take the perspective of others and to process complex knowledge compared to the prototypical VaKE. This positive result is underlined by high effect sizes indicating the practical significance of the intervention's effectivity. Additionally, for empathy the validity of the results are emphasized by using two instruments. The study has shown that it is of importance when teaching with VaKE to consider the learners' goals, values and interests with respect to the moral dilemma. Since a moral dilemma is the starting point for the learning process, it is crucial that it evokes positive emotions, such as curiosity and interest, and avoids negative emotions, such as fear or boredom which hinders effective learning. The results of this study are consistent with findings of other studies in the context of self-determination theory emphasizing the significant role of autonomy for learning and performance. There are several limitations of this study due to its quasi-experimental design (e.g., small sample size, possible selection bias, possible experimenter expectancy effect) and its organizational restrictions (e.g. different moral dilemma). An important implication for teacher education is to not only use VaKE as a rigid method but to adapt it to the particularities of the learners by providing more opportunities of choices. This can be done, for example, by allowing the learners to grapple with their own moral dilemmas (e.g., Weinberger et al., 2016).

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Authentic experiential work in the socialisation of undergraduate students: an EHEA-framed epistemological consideration

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Abstract

The European Higher Education Area (EHEA) is adamant about the role of employability in curriculum development and the overall education process of undergraduate students. This responds not only to the current emerging models of economic and social growth but also to an underlying epistemological shift regarding the very nature and characteristics of Education. This article provides the epistemological foundation of the said shift, arguing, from a post-positivist perspective, how authentic experiential work in the classroom may contribute to the progressive socialisation of students into their respective communities of practice, thus bridging the gap between the labour market and the education institutions.

Keywords: *experiential work; collaborative work; classroom methodology; epistemology; emergentism; higher education*

1. Introduction

The progressive socialisation of graduates in their respective communities of practice is regarded, these days, as one of the main goals in the education process of undergraduate students. Becoming an ‘expert’ in their field, following the Dreyfus and Dreyfus (1980) model of expertise, implies bringing professionals-to-be from the periphery of their respective professional community to its very centre, advancing from the ‘novice’ stage all the way through their education process (González-Davies & Enríquez-Raído, 2016). Indeed, Risku (2010:105) reminds of the importance, in educational settings, of paying appropriate attention to the actor-network relations in the profession, since, at the end of the day, the functioning and internal rules of a socio-professional community, Marco adds (2016:34), depend exclusively on its members.

The assumption reflected above, which is widely accepted at present and understood to be rather obvious in tertiary education, implies a particular epistemological stance that embraces a number of post-positivist premises, namely Deweyan, insofar it believes that “education is not preparation for life, it is life itself” (Duffy & Cunningham, 1996:4). Thus, the learning activity, analysed in Deweyan terms, results from the interaction of meaningful, important experiences within the learner, and thus their needs and interests as future members of the relevant communities of practice is believed to stand as one of the cornerstones of any third level educational approach.

Yet, the professionals in charge of those education processes rarely possess the relevant pedagogical background. Quite on the contrary, they are expected to know how to teach, how to guide the education process of their students and have an active role in curriculum development, lesson planning, etc. (Kiraly, 2014), which leaves lecturers in a rather ‘swim or sink’ situation in their classrooms while “more attention is paid, for example, to their training as researchers in their discipline” (Kelly, 2008:108). It may come as no surprise, then, that the absence in many cases of a solid background in Educational Philosophy and Pedagogy may result in a rich plethora of pedagogical perspectives and educational aims with various, sometimes even over-lapping, epistemological (unconscious?) beliefs. This ‘common sense epistemology’ (Bereiter & Scardamaglia, 1993), based on intuition, observation, imitation or even perpetuation of teaching practices, may be said to be the basis of a significant part of our current teaching and learning classroom methodology.

One could wonder how this methodological and epistemological hotchpotch has somehow accepted the current common belief regarding not only the importance of Dewey’s ‘learn-by-doing’, but also the role of experiential work and the student-centred nature of Education. Indeed, contemporary educational approaches cannot be separated from post-positivist grounds, namely constructivist, even if the degree of the implementation of those post-positivist ideals may vary from field to field, and from lecturer to lecturer, rendering a

complex picture in terms of how we believe third level education should be, here and now, how it really is, and all the possibilities in between.

The irruption of the European Higher Education Area (EHEA) has indeed contributed significantly to the shift in the mainstream third level education paradigm. As we have argued elsewhere (Martínez-Carrasco, *in press*), EHEA has re-modelled degree programmes, classroom methodologies, assessment procedures, and even the very role of students and educators in an attempt to “build upon its intellectual, cultural, social, scientific, and technological dimensions” (Bologna Declaration, 1999:1-2). The EHEA structure, framing tertiary education and providing the relevant legal and institutional grounds, has served effectively to spread and promote the current epistemological third level education scenario.

2. Current educational epistemologies: a situated hagiography

The nature of knowledge itself and knowledge acquisition may be roughly ascribed to three major epistemological stances shaping the idiosyncrasy of the teaching profession (Davis & Sumara, 2004; Doll, 2002): empirico-rationalist approaches, constructivist approaches and emergentist approaches. While the first one seems to have been condemned to public scorn these days insofar it is believed to represent traditional educational ideas based on lecturer-centred performance, memorisation and recitation, one needs to acknowledge the relevant role these positivist trends have played and still play in Education. At the end of the day, as Kiraly recognises (2016:53), it is just a matter of the way reality is conceptualised, so no epistemological approach may present any claim to universal truth but rather a situated contextualisation of the affairs. The said opinion is shared by a number of authors who claim the validity of mixed, eclectic epistemological stances to be applied to third level education (Kinchin & Hay, 2007:4; Cronjé, 2006:393)

In contrast, the constructivist epistemological spectrum has gained momentum in educational settings, at first on earlier stages of education and since the implementation of EHEA also in tertiary education. EHEA finds in constructivism the epistemological backbone of some of its main objectives, namely employability and lifelong learning (Commission/EACEA/Eurydice, 2015). Through the constructivist perspective, education becomes learning (Biesta, 2013b) since the underlying rationale it presents assumes that the learning activity occurs within the cognition of the individual, who makes sense of the world when contrasting their cognitive structures to the reality outside them. It is thus the cognising agent (von Glasersfeld, 2005) who, as a result, ‘builds up’ particular cognitive structures, be it through social interaction (hence the ‘social’ tag of constructivism) or within one’s own cognition (Piaget’s ‘radical’ brother of social constructivism).

One of the ways EHEA articulates its epistemological stance towards better employability of the European graduates is the use of competences, traditionally applied to vocational

training given its more professionally-oriented nature (Halász & Michel, 2011:289). If employability is to be one of the main goals of third level education, then formulating the respective learning outcomes in terms of competences, skills, and abilities makes complete sense as opposed to the traditional knowledge attainment criteria. Indeed, the current emerging models of economic and social growth explored by Biesta (2013a) and De Ketele (2008), among others, reflect the use of competences in a post-positivist environment as a tool to bring the labour market closer to university education, hence the fundamental role of experiential work embedded in the curriculum.

The main tenets of these post-positivist trends are summarised by Doolittle and Hicks (2003) and contemplate the individual and socially-mediated nature of the learning activity, the importance of authentic and real world environments, the role of the learner's prior knowledge and experience, and the self-regulated, self-mediated, self-aware nature of the construction of knowledge. This conceptualisation of learning reflects the degree of complexity of cognitive development and calls for particular adaptation, self-organisation, and interaction processes in the education of undergraduate students. In fact, the perks of socially-mediated learning embedded in authentic environments have been highlighted by many (Robinson *et al*, 2016) as a unique channel for lecturers to push the boundaries of their students' cognitive actual development level, using Vygotskian terms.

2.1. The irruption of Emergentism

Authors like Doolittle (2014) have integrated the characteristics of complex thinking, which has become increasingly popular in the last 30 years (Davis & Sumara, 2008:35) into a constructivist model, and speak of 'complex constructivism', or 'emergentism', advising that complexity stands as "a broad-based theory concerning the evolution and functioning of non-linear systems that may be applied in many domains", education included (Doolittle, 2014:490). Indeed, emergentism allows to understand education as a complex, trans-disciplinary activity and provides a fresh insight on questions such as sense-making, teacher-learner relationships, classroom dynamics, etc. (Davis & Sumara, 2008:34).

Kiraly (2016:61) sheds light on the matter speaking of the nature of complex and complicated systems regarding the emergentist epistemological grounds. Emergentism, he asserts, understands complex systems as something beyond the sum of its parts, something with *emergent* properties. Learning, as Davis and Sumara point out (2004:101) "is not about acquisition, processing or storing, but about *emergent* structuring". Similarly, De Bot *et al* (2007:7), in the context of Dynamic Systems Theory and its application to educational settings, speak of the difficulty of education insofar systems (here, cognitive structures) are constantly changing, developing through interaction with the environment and through processes of internal reorganisation.

Cognition, understood as a complex system, allows for mind-as-a-brain conceptualisations, something in constant construal and re-organisation, as opposed to the traditional constructivist mind-as-a-computer metaphor. Some even speak of shared cognition and mind-as-a-rhizome interpretations (Duffy & Cunningham, 1996:8), claiming that cognition may be socially shared and stored, removing it from the actual individual. This very last metaphor is remarkably interesting insofar it follows that the learning process may be nothing but a “dialogue and negotiation with and within a local sociocultural context” (*ibid*:12), where authentic, experiential work embedded in collaborative projects may play a crucial role.

3. Implications in classroom methodology

Building on the epistemological shift argued above, it comes as no surprise that the new epistemological stances have required a different approach in the teacher-learner relations, but also in class methodology and the way the curriculum is drafted, presented, and applied in contemporary classrooms. From an *apparently* old-fashioned positivist, teacher-centred methodology, the current institutional framework pushes lecturers to bring students to the very centre of their learning activity, and thus promote their emancipation as individuals and their progressive socialisation into their communities of practice. To that concern, Kiraly (2000:22) welcomes the epistemological discussion above since it promotes further debate on pedagogy and educational implications. Besides, the scholar puts forward a number of classrooms models: from a transmissionist, teacher-controlled positivist model to a transformative, student-controlled model where the role of lecturers becomes that of a facilitator of the overall learning activity, in charge of the *scaffolding* (again, Vygotskian terms) of the education process of their students. To those models González-Davies and Enríquez-Raído (2016:7) add a fourth one, a ‘transactional’ model, which serves to bridge both epistemological stances.

García (2016:101), on post-positivist teaching methodologies, speaks of the authenticity of the learning activity and its context as an integral part of knowledge and effective learning outcomes, suggesting a project-based collaborative methodology that addresses real life situations. As the scholar argues, project-based learning, grounded in post-positivist epistemological approaches, presents an interesting number of characteristics promoting both the socialisation of students in their respective communities of practice and the current EHEAn quest for employability: authenticity (real problems, effective solutions), complexity (students are faced with complex matters relying on a number of variables), construction research and use of tools (researching, planning, implementing, reporting), autonomy (and subsequent responsibility). To that list one could add motivation, since the use of authentic materials in a project-based methodology tends to have a significant impact in the overall satisfaction of students, who see how ‘reality’ enters their classrooms and their project are vested with the legitimacy and liability of real-life affairs.

Regarding the way to integrate the use of authentic experiential work in the classroom, be it in a project-based fashion or any other methodological approach, González-Davis and Enríquez-Raído (2016:3) find three main common trends: approaches where students are presented in the classroom with a realistic task based on collaborative work, approaches where students engage real-life professional work through work placements and schemes (outside the classroom), and approaches where the previous methodologies are combined.

All in all, emergentism understands education as a situated, context-dependent activity (Risku, 2016:101), hence the importance that lecturers implement authentic or near-authentic tasks into their teaching, preferably in collaboration-based settings. Under this emergentist paradigm, it is only through *real, significant assignments embedded in authentic situations* that students are exposed to the complexity and constraints a professional in their field would meet in the course of their career (see Kiraly, 2016, for an extensive contribution on the use of authentic materials in the education of translators, for instance).

3.1. The socialisation of students under emergentist premises

EHEA's employability standards require that university lecturers go a step further away from their classic transmissionist role and make sure that their students develop the relevant knowledge, skills, and abilities that professionals in their field display, but also a sense of the idiosyncratic identity of their community of practice, the explicit and hidden norms, behaviour and values, sense of belonging, professional self-concept, etc.

Emergentism, as well as other post-positivist epistemological standpoints, does provide the ideal breeding ground for those aspirations to take place, understanding cognition, and therefore Education, as a complex entity with emergent properties. Under the emergentist paradigm, activities, tasks, and projects are understood in a situated, dynamic context that serves students to grow professionally and personally in an empowering education continuum that does fill the gap between the labour world and the education institutions.

As Risku acknowledges (2016:6), the use of authentic materials may indeed stand as the right vehicle to achieve the socialisation of students since it allows them to take full responsibility of their education process “gaining competence, especially when they take part in a dialogue and can assume a meaningful role in an authentic situation”.

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Impact of a teacher development programme on approaches to teaching in higher education

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Abstract

The Bologna process involved a strategic change that included in its policy agenda a move towards a student-centred scenario. In addition, a reasonable association may be assumed to exist between teaching development programmes and student learning outcomes. This research study focused on the impact that a brief yet intense formal and non-qualifying teaching programme, delivered as a seminar and supported by the University of Castilla-La Mancha (UCLM) in Spain, had on teachers' approaches to teaching measured by the most recent Spanish adaptation of the Approaches to Teaching Inventory (S-ATI-20). Results showed that there was a positive and statistically significant impact of the training programme on approaches to teaching measured by the information transmission/teacher-focused scale (ITTF). Poor attendance rate to this non-compulsory programme, course duration, participant profile, psychometric structure of the questionnaire used, and the relationship between teaching development programmes and approaches to teaching are discussed.

Keywords: *Teacher development programme; teacher training; approaches to teaching; teaching approaches; higher education.*

1. Introduction

For the last decades there has been an increasing interest in the quality of teacher training at European universities, an interest fostered yet not originated by the creation of the European Higher Education Area (EHEA) and the well-known Bologna process. The Bologna process involved a strategic change that included in its policy agenda a move towards a student-centred scenario characterized by innovative teaching methods that should involve students as active participants in their own learning (Bucharest Communiqué, 2012) and where knowledge, skills and competences are keystones for holistic learning outcomes (Yerevan Communiqué, 2015) .

Research has shown that there is a direct relationship between teaching programmes and approaches to teaching (e.g., Gibbs & Coffey, 2004), and between teachers' approaches to teaching and students' approaches to learning (e.g., Trigwell et al., 1999). Therefore, a reasonable, though indirect, association may be assumed to exist between teaching development programmes and student learning outcomes (Prebble et al., 2004), which would match the EHEA objectives mentioned earlier.

Learning to teach in higher education is not a straightforward path. In fact, teaching may be one of the last “non-professions” (Baume, 2006). In most of Europe and other developed economies, university teachers are not required to obtain teaching qualification (Parsons et al., 2010) and Spain is not an exception (Zabalza, 2009). Thus, it is not rare to find an array of compulsory and non-compulsory teaching programmes offered by organizations (from universities to governments) with a variety of pedagogical or domain specific contents and aims. Nevertheless, “formal [sic.], sometimes mandatory, but non-qualification approaches have dominated most institutional and other arrangements, and developed under different strategic and funding stimuli” (Parsons et al. 2012, p. 7).

This research study focused on the impact that a brief yet intense formal and non-qualifying teaching programme, delivered as a seminar and supported by the University of Castilla-La Mancha (UCLM) in Spain, had on the approaches to teaching of the UCLM teachers who voluntarily participated in it. The authors were aware of the fact that there may be other sources of impact which should be explored, such as departments or institutions (Hanbury et al., 2008), yet these were not included at this stage in this study.

Teachers' approaches to teaching is a theoretical framework derived from the Students' Approaches to Learning tradition (SAL) based on the work of the Göteborg group led by Marton (1976). Years later, a more quantitative stream introduced the use of questionnaires to monitor students' approaches to learning (e.g., Biggs, 1979; Entwistle et al., 1979) and teachers' approaches to teaching (e.g., Trigwell & Prosser, 1996). Although there is a widespread misunderstanding of Marton and Säljö's initial findings (1976a, 1976b) and even a convenient but inaccurate reuse of phenomenographic methodology (see

Richardson, 2015), SAL is a sound theoretical background that, among other possibilities, would allow monitoring if teachers show a predominant Information Transmission/Teacher-Focused approach (ITTF) or, on the contrary, a Conceptual Change/Student-Focused approach (CCSF) (see Monroy et al., 2015), which would be in line with the premises set by the EHEA.

Our hypothesis was that well-designed teacher development programmes might have at least some impact on participants' approaches to teaching since approaches are context-dependent and not as stable as conceptions of teaching, even though both conceptions and approaches are related (Lam & Kember, 2006; Trigwell et al., 1999; Trigwell & Prosser, 1996). Thus, upon implementing a teacher development programme, three scenarios might be possible: 1) a decrease in participants' ITTF score, 2) an increase in participants' CCSF score, and 3) an improvement in both approaches (i.e. a simultaneous decrease of ITTF and increase of CCSF).

2. Method

2.1. Design

This research study used a pretest-posttest pre-experimental design with no control group.

2.2. Participants

The data were collected during three consecutive academic years (2014-15, 2015-16, 2016-2017) which allowed gathering an overall sample of $N = 85$, which was selected non-randomly. Of those participants, 75% ($n = 64$) returned the questionnaire administered at pretest and posttest, while 20% completed only the pretest ($n = 17$) and 4.7% ($n = 4$) only the posttest. All participants attended the programme voluntarily.

In terms of academic years, the distribution was as follows: $n = 48$ (2014-15), $n = 22$ (2015-16), and $n = 15$ (2016-17). Differences in the number of participants may be explained by the fact that the development programme was run on various occasions during the course of implementation, namely: three times along 2014-15, twice in 2015-16, and one in this academic year (2016-17) — it is expected that the course may be offered again in the second semester of 2016-17. It is worth noting that the sample might have been larger had the UCLM not cancelled three editions in which less than ten teachers had registered.

In terms of gender, the sample was biased as 63.6% was female teachers (36.4% was male). The median age was 42 years old ($SD = 9$). More than half of the sample (56.6%) reported having had some kind of teacher training along their career as teachers. Finally, the teaching experience of participants was recorded as shown in Table 1.

Table 1

Teaching experience of the sample in years

	n	%	accum.%
None	4	4.7	4.7
< 5	16	18.8	23.5
6-10	13	15.3	38.8
11-20	27	31.8	70.6
> 21	25	29.4	100

2.3. Procedure and instrument

The teaching programme was entitled “Educating at university: Keys to success” and was offered free of charge as part of the strategic training plan for the UCLM academic staff along other forty courses on teaching and non-teaching competences such as the use of ICT. This 20-hour programme focused on general pedagogical contents and methodologies (e.g., Problem-Based Learning, Reflexive Thinking, and Cooperative Learning) with a particular emphasis on assessment (Constructive Alignment). It was taught on one day for two consecutive weeks by three members of the Department of Pedagogy in different cities because the UCLM is a multicampus university. Between the two seminar days there were online tasks for participants to practise and consolidate learnt contents. At the end of the seminar and as an institutional requirement to pass the course, all participants completed a “happy sheet” satisfaction instrument, which is one of the most widely spread and prevalent ways to evaluate teacher development programmes (Chalmers & Gardiner, 2015).

In addition to this mandatory evaluation instrument and among other assessment tools, participants were asked to fill out the S-ATI-20 (see Monroy et al., 2015; Monroy & González-Geraldo, 2017) both before and after the seminar. Apart from minimum details, no further information about the aims and scope of this study were given to the participants.

The S-ATI-20 is a Spanish version of the Approaches to Teaching Inventory derived from a combination of the 16-item and 22-item versions developed by Trigwell & Prosser (2004) and Trigwell et al., (2005) respectively. The S-ATI-20 has 20 items which represent the two main dimensions identified in the literature: Information Transmission/Teacher-Focused (ITTF, 10 items) and Conceptual Change/Student-Focused (CCSF, 10 items).

2.4. Data analysis

Data collected via the S-ATI-20 were analyzed with IBM SPSS statistical package v. 22. Because of the novelty of this instrument in its adapted version to the Spanish context, a forced exploratory factor analysis (Maximum Likelihood with oblique rotation) was conducted. In addition, reliability with Cronbach’s alpha was calculated separately on the

pretest and posttest datasets in order to measure the psychometric properties of the instrument. Then, a related measures *t-test* was conducted to test our hypothesis.

3. Results

The results of the exploratory factor analysis supported the expected two factors structure of the S-ATI-20 found in previous studies (e.g., Monroy et al., 2015; Monroy & González-Geraldo, 2017). However, at posttest (35.2% of the explained variance) the results were clearer than at pretest (30.9%) as some items had low loading scores (e.g., item 4 at ITTF: .159), or loaded on the two factors simultaneously (item 6 at ITTF: .219; and at CCSF: .279). Reliability coefficients at ITTF (pretest: $\alpha = .648$; posttest: $\alpha = .757$) were lower than at CCSF (pretest: $\alpha = .749$; posttest: $\alpha = .774$), which match the results of studies with previous versions of the ATI (e.g., Hanbury et al., 2008; Prosser & Trigwell, 2006).

The results of mean comparison (Table 2) are shown following the pattern of the work of Hanbury et al. (2008) who also used the ATI (Trigwell & Prosser, 2004) but the 22-item version.

Table 2
Summary of ATI mean scores at pretest and posttest

Scale	Mean pretest	Mean posttest	<i>p</i>	Effect size
CCSF	3.95	4.00	.407	.11
ITTF	3.10	2.95	.009	.32

There was a positive, non-significant increase in the CCSF score and a significant decrease in the ITTF score with a medium effect size ($t[63]=2.709$, $p = .009$, $r = .32$). If each academic year was analyzed separately, the expected changes could still be identified (i.e. lower ITTF and higher CCSF at posttest) although statistically non-significant in any case. However, in this last case and because of the small size of the subsamples (per academic year), results must be taken with caution.

4. Discussion

Apart from the relative impact of the development programme, the most striking finding of this research study is the poor attendance rate. The UCLM employs more than 2,300 teachers (both part-time and full-time), and it is all the more worrying that only 85 teachers in three years were motivated enough to take on a course that would improve their teaching competences and thus potentially make them better professionals. It is true that not all teachers interested in the course had the possibility to actually complete it, as the programme was cancelled when there were less than ten registrees. Moreover, teachers had

to choose from an array of twenty programmes offered by the university, so it is likely that most teaching staff regarded a course titled “Educating at university: Keys to success” as a low-priority action. The fact that two thirds of the sample were women is an indicator that female teachers were more interested in what “education” is about at university. Finally, such an aloofness about teaching matters is likely not a coincidence in an academic world where the “Publish or Perish” leitmotiv, and even a more conspicuous “Share or Shame” motto (González-Geraldo, 2015), allows little room and time for non-research duties. Future lines should focus on examining the reasons for poor attendance rate to teacher training courses, as well as the meaning of the modest impact of such programmes.

Another interesting feature is that over half of participants reported having more than ten years of teaching experience, so the question arises as to whether junior teachers lack interest or do not believe in this type of teaching courses. Available time and future expectations regarding promotion are also against improving teaching competences at initial stages of an academic career. Thus, the classical saying *Primum vivere, deinde philosophari* could become “first research, then pedagogy”.

The results from this study support the two-factor structure of the instrument (ATI) posited in previous research. It is worth noting the use of a factorial procedure different from the “Little Jiffy” (i.e. principal components analysis with varimax rotation and eigenvalues greater than 1.0) originally used in the development of the ATI and typically applied in subsequent studies with factor analysis (see Meyer, & Eley, 2006). Nevertheless, future studies using the S-ATI-20 should revise the wording of some items, such as item no. 2, as one participant noted it was too long and difficult to understand.

Far from intending to generalize results, this study puts forward the importance of conducting teacher development programmes aimed at faculty, even if courses are short and of a duration below one year as recommended by previous research (see Parsons et al., 2012). The findings reveal that attitudes may change through a development programme, so the question remains as to whether such attitudinal changes would materialize in observable behaviour that could really make a difference in the classroom. Despite the fact the development programme was short, it is good news that changes are noticeable in such a short term. However, bearing in mind that the sample was different each year, we should remark that statistical changes were observed only after three academic years. Further research ought to focus on whether changes last in the mid-term and if they result in a better students’ learning processes and outcomes. Nevertheless, any impact on teachers tends to flourish after an incubation period and it is unusual to detect changes as quickly as those found in this study.

This study shows a positive relationship between teaching development programmes and approaches to teaching. The results may be of interest to university teachers wishing to improve their teaching competences and their students' learning outcomes, as well as to university administrators interested in the quality of universities from a teaching perspective.

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Satisfaction and Getting a Career: Employment Expectations of Undergraduate Students and Their Use of Support Services

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Abstract

The purpose of this paper is to explore the factors that affect higher education student satisfaction and future employment and their use of career and other support services while attending an institution. The descriptive results of this study suggest that while student satisfaction may be relatively similar for all academic programs, students utilize career and other support services very little. Most notably, the results also indicate students' expectations for employment was not related to their experience issuing these services. On the contrary, they were mostly satisfied with their academic and personal development. In essence, students felt prepared for the workplace based on their academic experiences rather than through other supports offered by the institution. This paper suggests that institutions' efforts are best placed on the academic and learning experience available to their students versus career and support services.

Keywords: higher education, satisfaction, career, support services

1. Introduction

Higher education institutions (HEI) and their programs benefit students, but also society as well. One goal for HEIs is to provide students with the skills and knowledge that they need to be successful in society (Bright & Graham Jr., 2016). HEIs can evaluate institutional performance by exploring and understanding student attitudes and perceptions during and after their educational experience. Education needs to assist students in achieving life goals and as such, it is worthwhile to evaluate the role of HEIs in students' lives (Bright & Graham Jr., 2016).

It has been argued that the decision to invest in an undergraduate degree is influenced by the ability to achieve higher income upon graduation for the duration of one's career (Elliot, 2002). In a recent US study, it was found that the expectation upon completion of an undergraduate degree is that the student would earn, on average, 10% more than someone with a high school diploma. This salary expectation and a successful transition to the labour market have been found to be motivators for the growth in degrees around the world (Uhlig, R. P., Mehta, K., Silverstone, S., & Mossavar-Rahmani, F., 2015). With students apparently making decisions to attend HEIs with expectations of income and employment, it is important for HEIs to understand these expectations before enrolment and throughout the student academic experience.

Other studies of students' opinions on the relationship between their educational experience and employment a few years after graduation include a survey of undergraduates who were at least two years' post-graduation in Spain. The results of this survey indicated that when asked to consider the hypothetical question of repeating their studies, 'graduates clearly place the highest level of importance on the quality of education' (Martínez, and Toledo, 2013, p. 66). In this instance, quality education was measured by theory-based and practice-based education, teaching quality, general academic support, and curriculum design (Martínez and Toledo, 2013). The authors determined that 'the development of competencies and skills and the fitness-for-purpose of studies in relation to the job market are very important dimensions—the latter more so in the choice of studies' (Martínez and Toledo, 2013). The conclusion is that education-to-job fit influenced students' satisfaction level with the area of study they pursued.

Martin et al.'s study on students' satisfaction with their education and how prepared they are for the workplace identified five factors related to satisfaction and workplace preparedness: 1) academic resources such as faculty/staff ratios; 2) faculty/staff attributes including quality of teaching; 3) student access to support resources; 4) curriculum such as breadth and depth of content; and 5) key concepts that related to theory and employment (Martin, Milne-Home, Barrett, Spalding & Jones, 2000). All of these factors are intrinsically related to the HEI itself and the academic program rather than extrinsic factors

such as labour market conditions or expectations, indicating that workplace preparedness is important to students, but expectations for employment do not rest with the HEI.

The literature suggests that students' satisfaction is an important factor to consider in terms of successful outcomes from their higher education academic experience. While the previous research points to some determinants of student satisfaction to be related to quality education, quality is a broad term, and students assess quality teaching and education subjectively. Alongside factors such as teaching quality, course content, and perceived skill development, Letcher and Neves identified non-academic factors when evaluating quality, such as extracurricular and experiential opportunities, availability of academic advising and mentorship, and the extent and modernity of institutional technology (Letcher & Neves, 2010).

2. Methodology

This study was conducted at a small-sized (less than 5000 students) higher institution in Canada that primarily provides undergraduate courses. The study was designed to evaluate institutional performance related to students' satisfaction and their preparedness for future employment endeavours. The target population for the survey was 750 degree-seeking undergraduate students registered at the home institution as of Week 3 in the Fall 2015 semester. For the purposes of analysis, only undergraduate data were explored. The survey was implemented over the institutional website via the student portal. Only graduating students were invited to participate. Of the 750 students who were eligible to participate in the survey, 260 responded—a response rate of 34.6%.

3. Findings: Satisfaction relates to academic experience

Survey data analysis shows that there was a high degree of student satisfaction with overall institutional experience: 75.6% of undergraduate students reported that they were 'satisfied' or 'very satisfied' with the overall quality of instruction (Figure 2). Likewise, a majority of students indicated that they were 'satisfied' or 'very satisfied' with the overall academic experiences at the institution at 75.3%, overall university experiences 71.6% and overall quality of university services and facilities 70.4%. While Business students were more likely to be satisfied with the overall quality of university services and facilities, Nursing students were more likely to be satisfied with the overall quality of instruction, overall academic experience, and overall social life. .

The survey asked students to answer to what extent their goals were achieved (until now) through their educational experience at the institution. Overall, most of the students reported that their goals were achieved at least to some extent. All measuring items were higher than 70%. Nonetheless, the students felt that 'being able to make more money,'

‘getting training for a specific career,’ and ‘being able to get a good job’ were less achieved than other goals. It was found that Nursing students were more likely to feel that their goals were achieved than other undergraduate students. Interestingly, students felt that ‘gaining a general education and appreciation of ideas’ and ‘learning more about things that interest me’ scored the highest on perceived goal achievement.

The survey was able to substantiate the students’ use of the support services offered by the institution by confirming whether they had actually used such support services. Overall, the results indicated indicate that few students made use of these services with any regularity. Nearly 75% of students indicated they never used career services, and 15% occasionally used to very frequently. Used this service. Career services were used most by Business students. The survey also explored the students’ expectations of future employment and career, including ‘effectiveness of university programs in preparing for employment and career, confidence that they would be able to obtain a paid job related to the current field of study, and expectations of working place and yearly salary’.

As presented in Table 1, regarding the effectiveness of university programs, the vast majority of undergraduate (85.5%) reported that the institutional programs and experiences were ‘somewhat’ or ‘very effective’ in preparing them for employment and career. In terms of confidence that students would be able to obtain a paid job related to their current field of study, nearly 7 in 10 undergraduate students (69.7%) reported that they were ‘very’ or ‘definitely’ related. With regard to pursuing a job and the study program, 43.9% of undergraduate students reported that they were ‘very’ or ‘definitely’ confident they would find a job in their field.

Table 1	Undergraduate Level					
	Arts	Business	Education	Nursing	Science	Undergrad Total
N	190	169	75	66	250	750
%	25.3%	22.5%	10.0%	8.8%	33.3%	(77.2%)
Not at all effective	3.3%	3.7%	0.0%	0.0%	5.8%	3.6%
Not effective	1.7%	0.0%	4.5%	0.0%	2.1%	1.5%
Slightly effective	6.7%	15.2%	0.0%	0.0%	12.4%	9.3%
Somewhat effective	40.0%	47.6%	59.1%	4.5%	52.9%	44.6%
Very effective	48.3%	33.5%	36.4%	95.5%	26.9%	40.9%
Mean Value ^{b)}	4.28	4.08	4.27	4.95	3.93	4.18
Not at all confident	7.0%	1.8%	4.2%	0.0%	9.3%	5.6%
Not very confident	11.1%	10.2%	20.8%	4.6%	18.2%	13.7%
Somewhat confident	49.1%	34.9%	33.3%	0.0%	40.3%	36.8%
Very confident	29.2%	33.1%	25.0%	40.0%	22.0%	28.3%
Definitely confident	3.5%	19.9%	16.7%	55.4%	10.2%	15.6%
Mean Value ^{b)}	3.11	3.60	3.29	4.45	3.06	3.35
Not at all related	7.2%	1.8%	0.0%	0.0%	7.9%	4.8%
Not very related	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Somewhat related	38.9%	29.9%	8.3%	0.0%	25.6%	25.6%
Very related	35.3%	44.9%	20.8%	25.4%	32.6%	34.3%
Definitely related	18.6%	23.4%	70.8%	74.6%	33.9%	35.4%
Mean Value ^{b)}	3.57	3.88	4.63	4.75	3.84	3.95

4. Discussion

These findings support previous research related to student satisfaction. Student satisfaction appears to be most strongly related to educational and academic experience while at a higher educational institution (Astin, 1984; Elliot, 2002; Douglas et. al, 2008; Mark, 2013). While other studies suggest that it is critical to link graduate employability to student satisfaction, this study supports the case that although these two factors are important considerations for HEIs, they are not necessarily indicative of students' perceptions of higher education satisfaction while in attendance at the institution.

Students place value on academic study and knowledge development, albeit they think about employment, but their attitudes and perceptions regarding their HEI experience relate to a broad range of learning experiences in higher education. Social network building, development as a critical thinker, learning on- and off-campus, cultural understanding, and generally becoming a more grounded person responsible for the community are viewed as important outcomes in their academic experience (Cranmer, 2006, Crossman & Clark, 2010, Barnett, 2011).

This study found all cohorts ranked 'gaining a general education and appreciation of ideas' as the top goal achieved in their academic experience followed by 'learning more about things that interest me.' All cohorts other than Nursing and Education students ranked career and financial goals lower. This may be a result of Education and Nursing being professional programs with preparation for employment embedded in their higher education experience. As a result, both cohorts may feel prepared for employment with specific income expectations being attainable.

However, students place a sizable importance on the current and future labour market at the time of choosing their area of study, in the hope that when they reach graduation, they will be able to find employment in their area of study (Martinez & Toledo, 2013). Student motivation to attend HEIs and student expectations related to labour market expectations are important factors to consider in terms of meeting student expectations and needs.

Overall academic experience and quality of instruction were the most important factors in student satisfaction ranking for this HEI. Students in this study indicate they believe their program was effective in preparing them for employment. However, they were less confident they would obtain a job in their field even though they were pursuing work in this area. It is interesting to note that these students believe the institution was effective in preparing them for the labour market, but their expectations of success in finding a job in the field were much lower. This would indicate the students perceive that the institution is doing its 'job' in preparing students for the labour market, but there is less confidence in what is available for employment. This also shows that students are aware that the labour market operates with specific rules that cannot be neatly translated into HE responsibility.

This ‘fitness-for-purpose’ is important so that HEIs, at least in the context of this study, which is Canada, continue to evaluate and enhance academic experiences so that they are satisfactory and relevant to students. Yet, if the educational system is too concerned with research outcomes and developments and places less importance in rewarding staff teaching engagement, this is problematic and may result in burdened and stressed academic staff.

Nearly 75% of the respondents in this survey indicated they never used career services during their undergraduate degree, but they were still satisfied with their HE experience. This suggests that in the Canadian context, students are seeking ‘an education,’ and an educational experience, and not merely a ticket to employability (Molesworth, et. al., 2009). However, the Canadian Chamber of Commerce suggests that mandatory informed career counseling services for students be implemented and suggest possible labour market benefits that would result from the successful implementation of such a career counseling services (Canadian Chamber of Commerce, 2015). It is believed the availability of labour market information can impact transition to the labour market for HE students. It was found that this availability of labour market information varied among different countries and, as such, impacted student reliance on various information sources. For example, in the United States and Canada, labour market information is surveyed, updated, and published on a regular basis, which provides continuous access to relevant information for students when making career and educational choices, Hence, it is up to students to decide to what extent this affects their choice. These resources are not available to students in many other countries. As a result, students tend to place a lesser importance on the assistance provided by guidance counselors (for example) in Canada and the United States as they can research trends in their area of study interest (Pitan & Olugbenga, 2014).

Many factors were found to impact student satisfaction in this study; however, income and labour market expectations did not appear to influence satisfaction. Students found themselves ready and effectively prepared for the labour market, with relatively realistic expectations of income. These findings are consistent with early studies that indicated that satisfaction is not directly linked to labour market readiness (Field, Holley, & Armenakis, 1974). However, given the demand for professional programs and the high satisfaction of those in professional programs, it is important for HEIs to be aware of student decision-making in choosing a program and how expectations and satisfaction evolve over time.

5. Conclusion

This paper explored the subject of satisfaction and career supports for undergraduate students. The findings of this research support those of previous studies related to student satisfaction and support, the importance of quality of instruction (teaching and learning approaches and strategies), and academic experiences in satisfying students (Bright & Graham Jr., 2016; Field, Holley, & Armenakis, 1974; Martin, Milne-Home, Barrett, Spalding, & Jones, 2000). These findings are consistent with research related to employment after graduation/preparation for employment, in that all cohorts felt prepared for employment as a result of their degree, but their expectations of the labour market were mixed due to labour market demand and realities versus the role of (or lack thereof) of HEIs in career preparation (Dragan & Ivana, 2015; Martin, Milne-Home, Barrett, Spalding, & Jones, 2000). This study is useful for HEIs' administrators, faculty, and staff, and those who explore methods to focus more on the value and improvement of teaching and learning at HEIs when it comes to students' satisfaction. It appears this satisfaction is linked more to those characteristics of academic and social development related to HEIs than what the HEI was doing to make students 'employable.' The findings challenge the justification of HEIs' 'employability' agenda in order to satisfy students' requirements and needs, and, consequently, satisfaction. They show that students are attending higher education for reasons that are more educational, holistic, personal, and social rather than 'finding a job,'. What this means is that students show an understanding that HE cannot and need not be governed by market rules.

Finally, students' motivation to attend higher education and to generate meaningful employment from their degree appears to be inherently embedded in society. A review of the literature and survey data indicates that students place significant value on teaching and learning as it relates to satisfaction. As a result, students may be satisfied with their undergraduate experience regardless of their expectation for employment. In essence, they felt prepared for the workplace and satisfied with the skills and knowledge they developed at university, regardless of job expectations. This study provides insight into student satisfaction and can assist HEIs in developing policies related to student retention and success. HEIs may find this study useful in developing policies and programs related to transitioning from undergraduate studies to the workplace.

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Testing the Trust Game with undergraduates: An experiment with wealth heterogeneity

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Abstract

Trust, reciprocity and a fair distribution of resources are crucial in the sustainability of any economic system. As a matter of fact, those are values that should be promoted among the new generations, especially among university students enrolled in degrees that are related to economics.

Under this context, we are interested in enhancing criticism and active reflection among undergraduates with respect to social values. With such a goal in mind, we designed a two step classroom task that includes playing the Trust Game (TG) in the first place and, second, a discussion activity.

This paper is an extension of Caballer-Tarazona et al. (2016) with a novelty: A new treatment is introduced in which subjects have information about the cumulated wealth of their partners.

As a complement of the educational purpose of the task, data collected during the experiment has been used to test three hypotheses on trust and reciprocity among students.

Two main results emerge: First, information has no effect on trust and reciprocity decisions. And second, in median a gender effect in such decisions is found.

Keywords: *Trust game; experiment; social values; trust; reciprocity.*

1. Introduction

Trust, reciprocity and a fair distribution of resources are crucial in the sustainability of any economic system. Moreover, those are basic values for putting up a rich social capital within the society (Dietrich, 2015). As a matter of fact, those are values that should be promoted among the new generations, especially among university students enrolled in degrees that are related to economics, since trust and reciprocity are basic elements in economic decision making.

We are convinced that such moral and ethics values which directly affect economic decisions should be promoted among university students in general, and especially among students within economic degrees. Therefore, we propose in this paper a classroom activity aimed to create an open framework to allow students to develop a critic opinion and autonomous reflection in social values, specifically on trust and reciprocity. Previous experiences show the efficacy of implementing experimental games as a classroom activity with educational aims (see Rodrigo-González and Caballer-Tarazona, 2015).

With this goal in mind, we designed a classroom activity based on experimental economics. The literature provides some experiments aimed at testing trust and reciprocity behavior (Berg et al. 1995 or McCannon, 2014). We follow the work by Caballer-Tarazona et al. (2016) where students take decisions without knowing the partner's cumulated wealth. Specifically, we extend that experiment by including a new treatment in which students are provided with information about cumulative wealth. Thus, they take decisions under wealth heterogeneity conditions. It allows us to evaluate the wealth heterogeneity effect on trust and reciprocity.

The task was carried out in the course of "Introduction to Bachelor studies¹", that is placed in the first year, first semester of degrees in Business Administration and Tourism of the Faculty of Economics at the University of Valencia, Spain. The scope of this task is to study the effect that wealth information has on trust and reciprocity among undergraduates and to identify possible gender differences.

Our general target is to make students reflect about the behavioral dynamics in the context of the Trust Game (TG), and any ethics and moral values that could emerge from playing it.

2. General framework

We test the TG among undergraduates. In the TG, a trustor is endowed with an amount of money E . The trustor decides which part of the endowment $x \in (0, E)$ to send to an

¹The course Introduction to Bachelor studies is a transversal subject that is aimed at facilitating the transition from student to the university environment, from a holistic approach that takes into account not only the competencies specifically on their degree, but also those related to the knowledge of the institution to which it belongs and its role in society.

anonymous trustee. The amount x is then multiplied by n in the trustee's hands. The trustee then decides which amount $y \in (0, 3x)$ to return to the trustor. Consequently, the payoff of the trustor is $\pi_{tr} = E - x + y$, and that of the trustee is $\pi_{te} = 3x - y$. Figure 1 shows the extensive form of this game, with thick lines showing the equilibrium path.

The game has two subgames. Subgame 1 is surrounded by dotted lines and subgame 2 is the game itself. The strategy "no transfer" is a Nash equilibrium strategy of subgame 1, that is, the trustee does not return any amount to the trustor in equilibrium. Subgame 2 has a Nash equilibrium strategy in "no trust", for the trustor, i. e. not to give money at all to the trustee. Thus, the subgame-perfect Nash equilibrium (*no transfer, no trust*) does not allow for any value creation nor reciprocity.

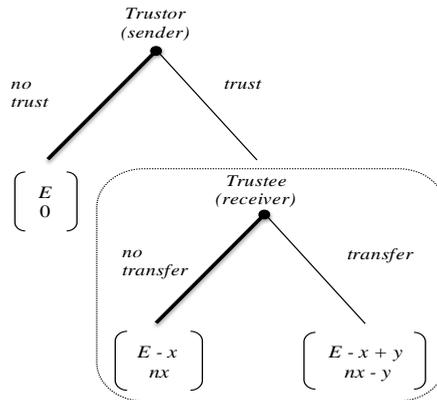


Figure 1. Extensive form of the TG implemented. Payoffs (up:Trustor; down:Trustee)

The experiment was run in LINEEX with 50 participants (20 males and 30 females). The experiment was programmed using z-Tree (Fischbacher, 2007). The activity was designed as a compulsory activity within the course "Introduction to Bachelor studies".

The session was carried out as follows: participants were first splitted in two groups and randomly assigned a role (trustor or trustee), then randomly matched at the beginning of each round. Anonymity was kept in order to prevent any trust-unrelated effect. In each round, both trustors and trustees are given an endowment of 50 ECUS. The trustor must decide how many ECUS to send to an anonymous trustee: an amount x in the set $\{0, 10, 20, 30, 40, 50\}$. The amount sent is then tripled in the trustee's hands. Finally, the trustee has to choose the amount of ECUS that she wants to give to the trustor: a strategy y in the set $\{0, 10, 20, 30, 40, \dots, 200\}$ which satisfies $0 \leq y \leq 3x + 50$.

To capture the information effect on trust and reciprocity, the baseline treatment T0 is compared to a new treatment with private information (T1) that allows us to contrast the claiming that initial inequality in wealth may have an effect on trust and reciprocity.

2.1. Hypotheses on Trust and Reciprocity

Denote as λ_0 and λ_1 the percentages of money sent by the trustors in treatments T0 and T1, respectively. As for trustees, denote as R_0 and R_1 the return rates in treatments T0 and T1, respectively. Three hypotheses we want to test: **Hypothesis 1 (H₁)**. To have private information about the trustee's cumulated earnings has a positive effect on the trustor's decision on $\lambda = x/50$. **Hypothesis 2 (H₂)**. Private information about the trustor's cumulated earnings has a positive effect on trustee's decision on $R = \frac{y}{x} - 1$. **Hypothesis 3 (H₃)**. There is a gender effect, so that females and males behave differently in trust and return decisions.

2.2. Session I: The TG repeated finitely in the Lab

This first session of the experiment was structured as follows: (1) **Hand delivering and reading instructions**: Students were provided with instructions about the trust game and the teacher read them loud (15 minutes). (2) **The game**: During 10 rounds, subjects played the trust game described in figure 1.(60 minutes). (3) **A questionnaire**: Open questions about students' opinions and perception about social values as well as for real meaning of the game (15 minutes).

2.3. Session II: Discussion

One week after playing the game, in a regular classroom, a second session took place in two phases: (1) **Presentation**: After delivering their single written dissertations on the chosen books, students were clustered in groups that have books in common. Each group shared opinions about contents, underlying the most interesting points, as well as likes and dislikes. They also summarized the content of the book and designed a speaker who explained the book to the rest of the participants (about 30 minutes). Finally, each speaker presented the corresponding book and answered their class-mate questions about the reading topic (about 30 minutes). (2) **Connecting ideas**: Students spent 30 minutes identifying the similarities between the real meaning of the experiment and the content of the books. First, each student individually wrote a note with his/her answers. Second, the teacher explained the TG theoretical predictions. Finally, she held conversations with students about fairness and opened vivid debate.

3. Data analysis

3.1 Experimental data

Figure 2 shows the histograms of the trustor's percentage sent and the trustee's return rate, per treatment. By testing H₁ and H₂ about a private information effect on agents' decisions, we fail to reject the null hypothesis at 5% by both Wilcoxon rank sum test and median test in trustor and trustee samples.

Result 1: Having private information about partner’s earnings does not produce, in median, any change in trust and reciprocity decisions.

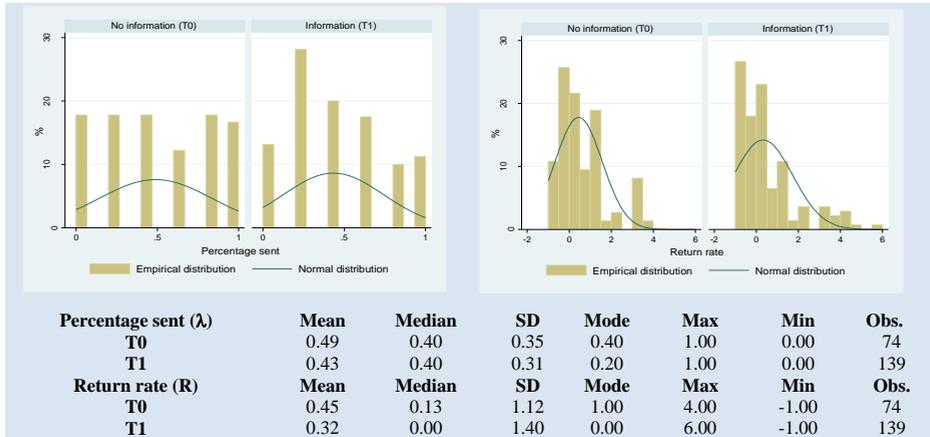


Figure 2. Relative frequency histograms (percentage sent and return rate), by treatment

As figure 3 shows, trustor-females sent higher median amounts than males in T0, but hardly less in T1. The opposite happens about returning decision. Testing H_3 leads next result:

Result 2: In median, gender differences are observed concerning percentages sent (λ) in both treatments: women send higher amounts than males in T0 but the opposite occurs in T1. Regarding return rates (R), gender differences are found in T1: females returned higher amounts than males in T1.

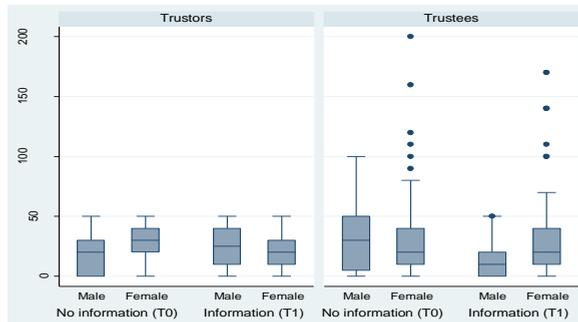


Figure 3. Distributions of type of players offers (by gender and treatment)

3.2 The Questionnaire

The questionnaire is divided into three blocks related to Gardner’s multiple intelligence. The first block includes questions about *intra and interpersonal intelligence*. Students were asked their own feelings and their guessing about their partners’ feelings in course of the TG. In particular, students ended the two following incomplete sentences by selecting the icon fitting better (sadness, indifference, happiness, malice, and anger).

“In this experiment, I have felt”



“I think that the people with whom I have played have felt....”



Interestingly, 45% of students marked the opposite box to their own feeling to indicate the partners' feeling (e.g. I'm happy, you're angry, or vice versa). In these cases, we suppose that students perceived the game's result as unfair, because one partner's happiness implied the other's anger.

Concerning students' propensity to solidarity, we provided them with the question **“Which adjective describes you better?”** Answers: selfish, egalitarian, and altruistic.

The most frequent answer was “egalitarian”: 77.8% in T0 and 93.7% in T1. In T0, 16.7% of the subjects declared themselves as altruistic and only one student as selfish. In T1, 0.3% of the students declared themselves as altruistic. Figures 4b and 4d plot the solidarity propension declared by trustees after participating in the experiment. Notice that in T0 two thirds declared themselves as egalitarian, and in the treatment T1 all of them claimed to behave as egalitarian. As shown, there are differences between students' answered solidarity propension and real payback decisions in the game (return rate).

Regarding students' trustiness to others, they had to chose one of the statements below associated to three trust levels: low trust (LT), medium trust (MT), and high trust (HT).

- I only trust people that I already know. (LT)
- I am confident in some circumstances, especially when I do not have much to lose. (MT)
- In general, I trust people unless they show me that they do not deserve my trustiness. (HT)

Figures 4a and 4c plot the trustiness level declared by trustors. In T0 most (55%) trustors marked HT, whereas in T1 half of the trustors selected LT. In addition, some differences between students' confidence level and decisions on the percentage sent in the game are observed. For instance, in median values, in figure 4a trustors 1, 3, and 9 sent amounts below the 50% of their endowment, but they had claimed that they trusted people as a matter of fact. In figure 4c, the discrepancy between facts and words is even more evident. As documented in related literature, we also looked for a possible friendship effect on trust and reciprocity behavior. For that purpose, we formulated an open question: **“Would you have played in the same way if you partner had been a friend of yours?”**

In T0, 55.5% of students would have changed their offers, while only 34.4% in T1. In both treatments, students who would have changed their behavior argued that they would have been more generous if playing against a friend or, at least, they would have followed a

collaborative strategy aiming at achieving equal earnings. Among the most frequent reasons given contained the words ‘generosity’, ‘cooperation’, and ‘trust’. The rest of the students considered their behavior quite generous and, therefore, they would have followed a similar decision pattern if playing with a friend. However, three of those students declared that “friendship and business do not mix together”.

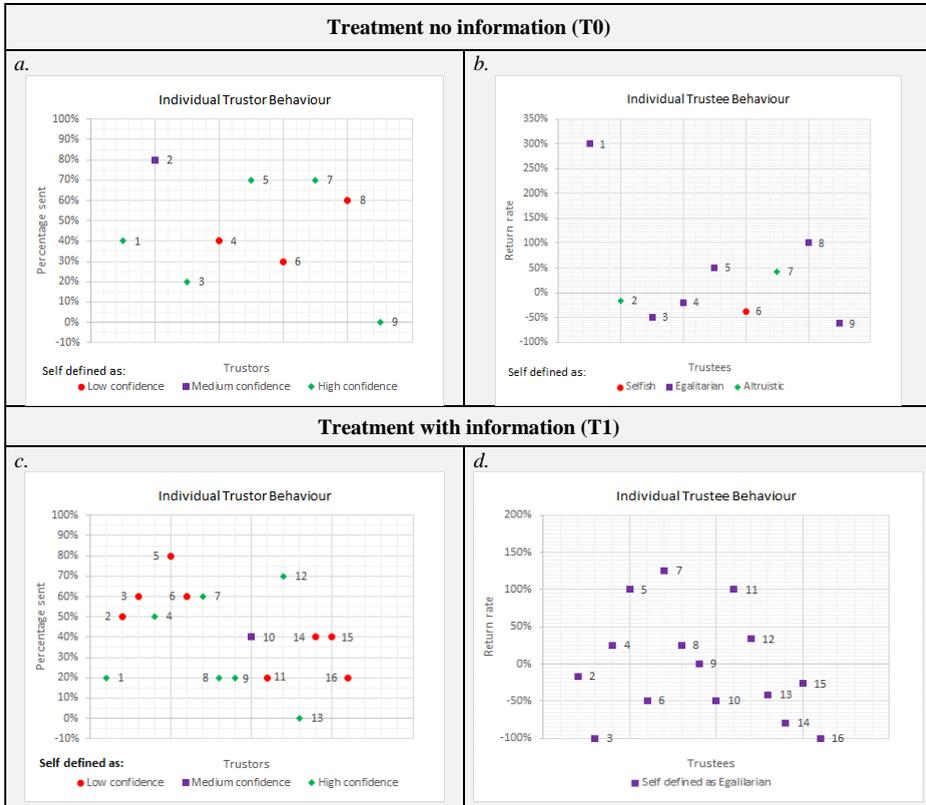


Figure 4. Differences between performed and declared behavior (median values)

The second block includes four open questions about *logical-mathematical intelligence*.

What do you think is the game’s core? Answers: Producing profit. Distributing resources. Observing generosity. Making investments. Taking strategic decisions. Taking risky decisions.

Would you have played in the same way if you had been rewarded in cash? Why? Answers: In T0, 46.7% of the students declared that they would have played in a different way if earnings had been in cash, and 56.2% in T2. They argued that they would have been less generous, playing more prudently and taking less risk. In contrast, students who would kept their behavior claimed that they did their best, being aware of the game and trying to

get the highest score in ECUS.

How would you have played in the opposite role? Why? Answers: We find a wide variety of poor and brief answers to this question (e.g. “I’d have played in the same way.”), which does not allow us to identify a general conclusion for each role.

What do you think is the best strategy? Answers: Some students answered “I don’t know”. The 30% of students argued that without knowing the goal of the game it was not possible to identify the best strategy. However, a few students furnished interesting answers, which we cluster in two groups: (1) **Collaborative strategy**. The 56% of students thought of sharing profits equitably. (2) **Competitive strategy**. The remaining 14% of students did not consider the partner’s interest and shared the minimum possible. This strategy was based on the short term profit (profit per round).

The questionnaire finished with an *existential intelligence* question: ***Which values are important for you?*** Answers: respect, honesty, solidarity, equality, fairness, trust, ambition and loyalty.

4. Discussion

First, experimental data allow us to test the three formulated hypothesis. We found that the information about wealth heterogeneity between partners produces changes neither in trust nor reciprocity decisions, in median.

Regarding the third hypothesis, some gender differences were found. Specifically, women send higher amounts than males in T0, but the opposite occurs in T1. In addition, higher amounts of the return rate were sent by women in T1.

Second, the conclusion of the whole activity was carried out in the last session, which allowed students to reflect about the activity core and exposed very interesting interpretations of the activity.

In the last session, students were clustered in groups per book in common for the presentation. During twenty minutes they discussed and summarized the main contents of the book. Each group selected a spokesperson who presented the summary to the class. Afterwards, a short debate spontaneously emerged in the class.

To connect ideas each student handed in a note with two questions: ***What topic do the readings have in common?*** Answers: *A social and egalitarian economy. A supportive model of economy based in cooperation and common good. Use resources for improving social well-being. Everybody deserves the same opportunities.*

What is the link between the game and the readings? Answers: *“Everybody takes advantage if we share resources”. “Trust, justice and social equity”. “Cooperation and trust as an essential element for archiving a proper wealth distribution and well-being for*

everybody". "Encouragement of a sustainability and egalitarian economy".

During this last part of the activity, we reached to engage students in a proactive participation and autonomous reflection, thus we accomplished our educational goal.

5. Conclusions

We focus on trust and reciprocity as fundamental elements in new economic contexts (e.g. collaborative economy, green economy or virtual economy). In order to understand new socio-economic paradigms, bachelors in economics must provide students with updated education. The activity presented here is a real stimulus for students' motivation that allows them to acquire and develop some essential skills like being able to think critically.

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Enquiry Based Learning: A Valuable Mechanism at Level 9?

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Abstract

This paper examines 'Enquiry Based Learning' (EBL) as an engagement strategy for assessment at 'taught masters' level 9. The master students in question are adult learners in full time employment and the empirical data was gathered from these students. First, an outline of the key features of EBL is presented and, from there, an investigation of how it is viewed when applied to a specific problem statement by the masters students. EBL creates a memorable atmosphere in the classroom and encourages deep learning (Ramsden, 1992). EBL also encourages active learning, which is more enjoyable for the students (Eison, 2010), especially adults – offering more control (Whowell, 2006). Learning should not be passive or a spectator sport; students learn most effectively by active engagement (Karmas, 2006), with an interesting project, hence, the use of EBL. It is vital that we move beyond a conceptualisation of education as the simple acquisition of knowledge to one which equally emphasises, nurtures and assesses innovation and expertise in the utilisation and application of knowledge, (Boland, 2010). The findings of this research are relevant and important as they inform practice and feed into future programme reviews when considering the inclusion of EBL for assessment.

Keywords: *Enquiry Based Learning (EBL), Assessment, Engagement, Adult Learners.*

1. Introduction

The engagement of Higher Education (HE) institutions with the wider community and engagement with the world outside of the institution setting has become part of the language of HE, (Hunt, 2011; Wynne, 2014). Engagement is an ‘umbrella term’ that covers a very wide range of strategies & activities (Wynne, 2014), but, in the context of this discussion on EBL, it leads to the encouraged use of working with ‘real life’ issues and problems outside of the educational institution for pedagogical enhancement. Attempts at engagement present challenges on two fronts: in the day-to-day order of how a university conducts its work, and in higher order considerations around values, identity and purpose (Wynne, 2014). Emphasis is placed on public scholarship, on sharing the expertise of the university more broadly, and on learning from communities, to contribute to public problem solving, where civically engaged universities are mindful of the contribution they make to the economy, (Wynne, 2014). Hutchings (2007) attempts to set out the philosophical bases of EBL, and argues that the true sources of EBL are to be found in enlightenment thought, its epistemology and in its aesthetics.

2. Research Context

The purpose of this research is to examine the use of EBL as an appropriate assessment tool for the adult learner at masters level. Adult learners are defined either based on their age, cognitive maturity, or, as a non-traditional learner (Yap, 2009). The adult learner brings a different perspective to the classroom and varying standpoints to education, in terms of emotion, motivation, and financial resource, when compared to students entering higher education through normal channels after second level education. Students learn differently in varying situations (Ramsden, 1992), and this is to the fore with adult learners. Connotation varies greatly with each student but especially with the adult learner (Ramsden, 1992). Considered reflection is therefore important when developing and applying appropriate assessment strategies for adult learners. EBL has been used for a number of years as an assessment strategy and, now, some informed student feedback is timely.

3. Literature

Solving problems in HE was developed initially for Medical education, (Ertmer & Simons, 2006), and different perspectives exist on its role in HE. Miles (2006) believes that the use of EBL in HE prepares students to be more effective in the real world situations in which they work, and to return to their places of work with the skills and knowledge that they need to develop policy & implement change. Advocates of EBL can outline numerous benefits of EBL such as teamwork, critical thinking, problem solving, deep learning etc., but are reluctant to acknowledge any disadvantages, such as the ability of students to gain and develop large knowledge about the particular topic, the difficulties for instructors and, in general, the need to change the ethos of the educational institution. Gaining large quantities of knowledge in a fast manner is typically suited to a traditional classroom situation and not problem solving. Problem solving is still not yet widely used (Ertmer & Simons, 2006). Implementation and operational issues around EBL & PBL are challenging and much more taxing for the instructor. Instructors need to have a much broader skill set, and be able to adapt and be flexible (Ertmer & Simons, 2006) to this changing learning environment when compared to traditional classrooms—the instructor is now facilitating and not instructing, and also a provider of scaffolds¹ (Resier, 2004) for the student. Transitioning to this type of guidance is exigent. Barrett (2005) considers problem solving not merely as a teaching & learning technique, but a total approach to education and outlines several philosophical principles underpinning Problem-based Learning; [(Lewin, 1943; Freire, 1972; 1985; Margeston, 1997)-in Barrett (2005)].

3.1. What is Enquiry Based Learning (EBL)?

Problem and Enquiry-based Learning are multifaceted in nature, and are not mere teaching techniques but rather total educational strategies (Barrett, 2005). According to Kahn & O'Rourke (2005), EBL describes approaches to learning that are driven by a process of enquiry. The tutor establishes the task and supports/facilitates the process, but the students pursue their own lines of enquiry, draw on their existing knowledge and identify the consequent learning needs. They seek evidence to support their ideas and take responsibility for analysing and presenting this appropriately, either as part of a group, or, as an individual supported by others. They are thus engaged as partners in the learning process (Kahn & O'Rourke, 2005), and students can actually take control of their learning (Whowell, 2006). EBL, however, while incorporating elements of PBL, also covers a broader spectrum of approaches (Kahn & O'Rourke).

¹ A teacher assists a learner, altering the learning task, so that the learner can solve problems or accomplish tasks that would otherwise be out of reach, (Resier, 2004:274).

3.2. EBL V PBL

Much of the literature uses the terms EBL and PBL interchangeably – although some theorists suggest differences. Kahn & O'Rourke (2005) outline for example, that EBL has a definite overlap with Problem-based Learning (PBL), where the handling of a problem defines and drives the whole learning experience of the students. EBL, however, is more far reaching in nature (Kahn & O'Rourke, 2005). Problem Based Learning originated from innovative health sciences and progressed into mainframe schools and Universities. PBL is a learner-centered approach—students engage with the problem (Savery, 2006). Problem-based Learning is seen as a set of approaches under the broader category of Enquiry-based Learning and is a total approach to education (Barrett, 2005). Within PBL, significant time is involved in the search for relevant resources. If a sufficient set of relevant resources has already been collated, then the time for searching will be reduced (Kahn & O'Rourke, 2005). In PBL, the students define their own learning issues (Barrett, 2005). Interestingly, one of the main defining characteristics of Problem-based Learning, which distinguishes it from some other forms of Enquiry-based Learning, is that the problem is presented to the students first at the start of the learning process, before other curriculum inputs (Barrett, 2005). This is an important point to note.

By contrast, EBL advocates a wider use of project work or research activity, emphasising the use of project-work to master a given body of knowledge itself, and not simply to make connections within an existing body of knowledge. This approach is a key factor that distinguishes an enquiry-based approach from a more traditional use of projects. During the EBL process, students are facilitated to construct their knowledge (in Kahn & O'Rourke). Certainly, EBL facilitates deep, and especially, memorable learning (Whowell, 2005), and is now implemented in higher education institutions across the U.K. and world-wide in a wide and diverse list of subject areas (Whowell, 2006).

4. Methodology

The main objective of this research is to inform practice, and examine the value of EBL with more appropriate informed thinking at masters level. For the purposes of this research study, it was considered appropriate to apply a positivistic research methodology. A quantitative research survey instrument using Likert questions was devised based on surveys and suggestions on educational research on Survey Monkey. Quantitative measurements and hard facts may be of more use in demonstrating concrete achievement to the researcher (Harvey, 1998). The survey was completely confidential as it was deemed that it was necessary to make contributions confidential and anonymous to access negative feedback (Harvey, 1998). This allowed graduates the freedom and confidence to make a relevant and genuine contribution to the research. Sixty two graduates (male & female 23-

55 years of age), consisting of the total population for the last three years of the taught masters programme, were invited to give feedback on this method of assessment. This was considered an appropriate sample size; more students could have been invited to participate, but it was believed that a more recent pool was more beneficial. Prior to sending out the survey, the questionnaire was tested to eliminate any errors and cleansed prior to surveying the sample proper. When the survey was ready, an email was sent to the sixty two graduates with the survey link attached with a request to complete same in the interest of improving practice. Four of the emails bounced (the emails on file were work emails), implying that the graduates had moved from their work and relevant email to another position. Therefore, the working sample was reduced to 58. The response rate was good with 40 graduates of the relevant 58 taking the survey – a response rate of 68.96 – 70%.

5. Findings

On the masters programme, the use of EBL is encouraged and considered the best approach for assessment at group level within HE. The key reason for using EBL and not PBL is due to the fact that the ‘Enquiry’ assignment is not presented to the students until week 4 of the term, (in line with Barrett), as it is necessary to present relevant theory to the groups in advance of their ‘Enquiry’ process so that they are fully informed. For the initial lecture, the format & process of what will happen throughout the module is provided to the students (Hadgraft, 2000). Findings from this research, however, reveal that graduates would actually like to get the problem earlier in the term due to its short nature (12 weeks) prior to week 4.

For the EBL, an organisation is chosen by the lecturer (who will facilitate the learning), and the research problem is developed in conjunction with the organisation. Overall, and in line with the literature, respondents were satisfied with the quality of the organisations, and derived particular satisfaction when it involved a ‘not for profit’ organisation (86%) especially. Problems that are current, local, relevant, & authentic were welcomed by respondents as they are viewed as beneficial to both parties to the exercise. “The best elements of the course were the live case studies and the guest speakers”. “The speakers from industry worked very well and gave excellent insights into their companies and problems”.

This research findings found that EBL as a method of assessment was both engaging and challenging for students. 89% stated that EBL was challenging, but in a “positive way”, with only 7% stating that it was “stressful”. When asked about working together in groups to ‘problem solve’; 38% stated that problem solving in groups “helped me to work better in a team setting” and ultimately, in a work setting. 38% stated that it improved their professional development skills, and 25% stated that it improved their communication skills.

In line with the literature, when setting the EBL problem, it was important that a clear language & unambiguous terminology is used to define concrete concepts & goals, & acknowledge & reward successful outcomes (Wynne, 2014). Sophisticated problem solving requires strategies for planning and guidance with good quality scaffolds (Resier, 2004). The EBL “forced us to structure our learning and to plan well”.

By contrast, some respondents were concerned with ‘free loading’, where weaker students gained an advantage by using EBL. “By nature, group work tends to allow weaker team members to coast on the coat tails of others, so, perhaps, a certain structure within the group work scenario could be established to address this”. It could be easy for some students to be ‘carried along’ particularly in larger project groups”. On balance however, students engaged well with the EBL. “I loved working with actual companies and believe that these types of projects benefitted me most”. Overall, the participants were satisfied with the assessment strategy applied for the EBL; (presentation to the relevant company and feedback from same), with 86% stating this. However, concern was still expressed in terms of ‘free loading’ of students.

6. Discussion & Conclusion

Tell me and I forget, show me and I remember, involve me and I understand, (Spronken-Smith).

Biggs (1999a) believes that setting a problem and encouraging enquiry is a perfect way to assess students and it also complies with alignment. The findings of this research support that concept. Some graduates expressed a concern around the ‘free loading’ of others while working on the EBL; however, a solution to this can be found by offering a range of assessment methods, matching the complex open-ended nature of an enquiry (Biggs, 1999b). Macdonald (2005) notes that the real challenge is to make assessment rewarding, challenging, and a fun learning experience! This is mirrored in the research findings.

This research recommends the application of a Tripartite Assessment (Macdonald & Savin-Baden, 2004), while using EBL at masters level. Firstly, the group submits a report for which they receive a mark. Secondly, the individual submits the piece of work they researched. Finally, the individual writes an account of the group process that is linked to the theory of group work. These three components are added together to form the overall individual mark (Macdonald & Savin-Baden, 2004). The advantage of this is that it does not privilege some students who do less work, and an individual student will be responsible for gaining two-thirds of the marks and therefore most students perceive this kind of grading as being fair (Macdonald, 2005). This solution will address the ‘free loading’ concerns expressed in this research.

Participants also expressed the view that they are anxious to start the EBL as soon as possible in the term before week 4, for example. This may need to be addressed given the short term time of 12 weeks. If this is to be considered for the future of the masters, then the EBL as defined by Barrett (2005) may well have to become a PBL where the problem can be presented prior to academic delivery. Theorists provide much debate around the ideas & philosophies for the use of EBL & PBL, with advocates providing compelling benefits in the literature. The use of any type of problem solving certainly provides new challenges for instructor & student alike, but, on balance, the case for its use in a blended format is compelling. EBL certainly presents the benefits along with disadvantages for student & lecturer alike, but, holistically, the advantages have a clear recompense, as the students will reap the rewards of being able to undertake EBL as if part of a 'real life' team in an organizational setting, as outlined by one student, "projects where you work with real companies are supremely productive & invigorating!".

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Effect of an educational game on student's learning: different approaches for evaluation

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Abstract

The aim of this work was to evaluate the effect of an educational game about cardiac cycle, used as replacing or complementing activity for traditional teaching methods, on the learning of physiology students by using different evaluation approaches. The comparisons were made between the grades obtained in pre- and post-tests applied before and after the use of the game, and between the number of correct answers of groups that performed an activity with the puzzle or had a lecture or reading, in the same or different careers. In all these approaches, the students who performed the activity with the educational game had a better performance in the assessment tests in comparison with those who did not use the educational game. This effect was observed when the puzzle replaced a lecture or reading activity and also when it was used as a complementary activity after a previous lecture. In conclusion, the results of the present study showed that one educational game used as active teaching-learning method can improve the students' learning, and that its effect on student's learning can be evaluated by different approaches by the teacher during the classroom routine.

Keywords: *active teaching-learning methods; educational game; evaluation; physiology; professional education.*

1. Introduction

In addition to technical knowledge, undergraduate courses should provide the development of skills to educate health professionals with a generalist, humanist, critical, and reflective profile, to act in all levels of healthcare based on scientific and intellectual precision (Rodenbaugh *et al.*, 2012). For this, students should be engaged and motivated in order to learn; teaching methods play an important role in this process.

It has been reported that active teaching-learning methodologies may increase the engagement and learning of students (Prince, 2004; Mitre *et al.*, 2008). These methodologies include the educational game: a competitive activity, a simulation or a non-competitive exercise with rules and procedures (Allery, 2004). Educational games can be a complementary activity to lectures or replace them. While some authors reported that educational games improve students' learning (Rao and Dicarlo, 2001; Barclay *et al.*, 2011; Choudhury *et al.*, 2015; Luchi *et al.*, 2017), others did not (McCarroll *et al.*, 2009; Diehl *et al.*, 2015).

Students from health sciences careers need to learn the morphofunctional characteristics of the circulatory system. In the future, this learning will be necessary for them to orient the population, diagnose and treat cardiovascular diseases adequately (Abreu *et al.*, 2014). However, it is not easy to students to relate the morphological characteristics of the heart with its continuous and efficient functioning. This theme is called cardiac cycle and is studied in physiology course.

Considering the teaching of the cardiac cycle, it has been developed by our group a cardiac cycle puzzle (Marcondes *et al.*, 2015). Students of Biology, Medicine, Pharmacy and Nursing careers evaluated the cardiac cycle puzzle as useful for their learning (Marcondes *et al.*, 2015). Cardozo *et al.* (2016) observed that Dental students who made an activity with this puzzle had fewer errors and higher grades in a test applied immediately after the activity, in comparison with students who had read about the same topic.

The aim of this work was to evaluate the effect of the cardiac cycle puzzle used as replacing or complementing activity for traditional teaching methods, on the learning of students by using different approaches during regular classroom routine.

2. Methods

This study involves 4 different approaches to evaluate the effect of the educational game on students' learning:

Study 1: Comparison of the performance of the same students from the same career, course and semester, in a test applied before and after the use of the cardiac cycle puzzle (pre- and post-test approach);

Study 2: Evaluation of the performance in a test by comparing students in the same career, course and semester, divided into 2 groups: control group who had a lecture about cardiac cycle, and game group who performed the activity with the puzzle.

Study 3: Evaluation of the performance in a test by comparing students, in the same career, course and semester, divided into 2 groups: control group who had studied the cardiac cycle by reading, and game group who performed the activity with the puzzle.

Study 4: Comparison of the performance in a test of students from the same course and semester, mixed from different careers, equally divided into 2 groups: control group, who had a lecture about cardiac cycle, and game group, who had the same lecture plus the activity with the puzzle.

The tests used for learning assessment were composed by open or multiple choice questions about basic concepts of the cardiac cycle and the application of these concepts in situations of cardiac alterations or pathologies. The same questions were used for control and game groups in the same study, but not among the different studies.

Participated of this work students aged 18 to 25 years, from 3 institutions and 4 careers: 132 from Dentistry, 50 from Medicine, 36 from Nursery and 48 from Physiotherapy courses. The students were taking Physiology courses. In all the studies, the comparisons were made by comparing students from the same institution, who had used the puzzle and those who not. In order to avoid any comparison among the careers and institutions, the identification of which students who participated in each study will not be described.

2.1. Activity with cardiac cycle puzzle

Briefly, in groups of 4-5 participants, students received the puzzle containing pictures of the cardiac cycle phases, one table and chips for filling the table as described previously (see Marcondes *et al.*, 2015). They were asked to identify the correct sequence of the figures of the phases of the cardiac cycle. After that, the students were instructed to fill in the table with chips that indicated the state of the atria and ventricles (contracted or relaxed) and the cardiac valves (open or closed), the name of each phase of the cardiac cycle and the moment when cardiac sounds occurred. Graduate students or Physiology professors were monitors of the groups, showing whenever there was an inaccuracy, and asking questions, so that students could find out the mistake by themselves and correct it. The game represent a challenge because it is necessary to relate previous knowledge in order to place the chips in a correct way and answer questions about the relation of heart morphology and

physiology, as described previously (Cardozo *et al.*, 2016). During the activity, the students should have used the game to describe to the monitors the sequence of cardiac cycle events and explain how the morphological and physiological characteristics of the cardiac muscle contribute to the cardiac cycle (Cardozo *et al.*, 2016).

2.2. Study 1: pre- and post- test applied to the same students

Sixty-five students attended a theoretical class (50 min) on the basis of cardiac physiology. They were instructed to read about the cardiac cycle in a Physiology textbook for evaluation to be done in the next class. At the beginning of the second class, one pre-test composed of multiple-choice questions was applied. After this test, the activity with the cardiac cycle puzzle was performed. At the beginning of the third class, the test was repeated. The grades obtained in the pre- and post-test were compared by paired Student t test ($p < 0.05$).

2.3. Study 2: comparison between lecture and puzzle activity, in the same course and semester

Sixty-nine students were divided in two groups: control and game group. In class 1, both groups had a lecture about the characteristics of the cardiac cells together. All the students were oriented to study these topics and also the cardiac cycle in a didactic book. In class 2, the control group had a lecture about the cardiac cycle with a detailed description of the phases of the cardiac cycle, and the relation between the cardiac muscle characteristics and the events of cardiac cycle. The game group carried out the activity with the cardiac cycle puzzle. In class 3, all the students did a test with open and multiple-choice questions. The grades obtained in the test by students from control and game groups were compared by unpaired Student t test ($p < 0.05$).

2.4. Study 3: comparison between reading and puzzle activity, in the same course and semester

Fifty students were divided in two groups: control and game group. The same procedures described for study 2 were followed in class 1. In class 2, the game group performed the activity with the puzzle and the control group was instructed to study the discipline contents in textbooks and scientific articles during the same period. In class 3, all the students did a test with open and multiple-choice questions. The number of correct answers of control and game groups was compared by unpaired Student t test ($p < 0.05$).

2.5. Study 4: comparison between lecture and lecture plus puzzle activity, in a mixed class

Eight-four students from mixed classes with students from two undergraduate careers were divided in two groups: control and game group. Both groups had a lecture about the cardiac cycle with a detailed description of the phases of the cardiac cycle, and the relation between the cardiac muscle characteristics and the events of cardiac cycle. Additionally, the game group carried out the activity with the cardiac cycle puzzle. After all, all the students did a test with multiple-choice questions. The number of correct answers of control and game groups were compared by unpaired Student t test ($p < 0.05$).

3. Results

3.1. Study 1 – pre- and post- test: The grade obtained in the post-test was significantly higher than in the pre-test (Figure 1A; ($t_{(64)} = 4.445$; $p = 0.0003$).

3.2. Study 2 – comparison between lecture and puzzle, in the same class: The group that performed the test after the game activity had higher scores, in comparison with the control group that attended a lecture before doing the test (Figure 1B; $t_{(67)} = 3.654$; $p = 0.0005$).

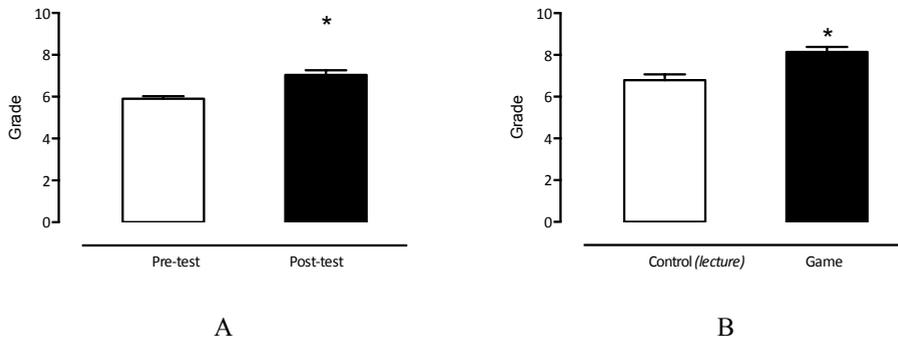


Figure 1. Performance of the students in pre and post-test about the cardiac cycle. *Significantly different from pre-test. (1A.) Performance of the students who had a lecture or an activity with the cardiac cycle puzzle in a test about the cardiac cycle. *Significantly different from Control group (1B). Values are presented as mean \pm SEM.

3.3. Study 3 – comparison between reading and puzzle activity, in the same class:

Students that performed the game activity answered more questions correctly, in comparison with those who learned the cardiac cycle by reading textbooks and articles (Figure 2A; $t_{(48)} = 20.90$; $p = 0.003$).

3.4. Study 4 – comparison between lecture and lecture plus puzzle:

Students that performed the game activity additionally to the lecture answered more questions correctly, in comparison with those who learned the cardiac cycle by lectures (Figure 2B; $t_{(82)} = 5.831$; $p < 0.0001$).

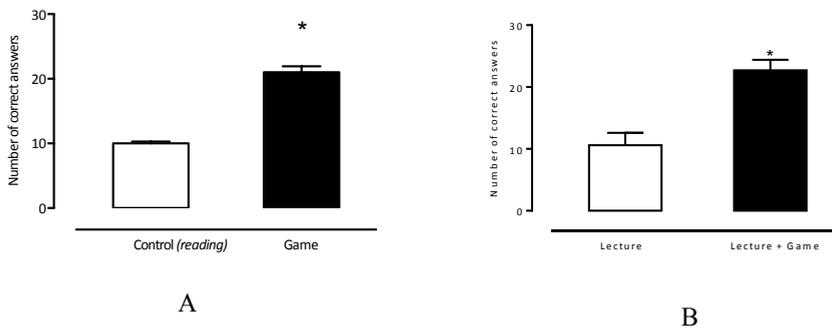


Figure 2. Performance of the students who read textbooks and scientific articles or had an activity with the cardiac cycle puzzle, in a test about the cardiac cycle. *Significantly different from Control group (2A). Performance of the students who had a lecture or a lecture plus an activity with the cardiac cycle puzzle in a test about the cardiac cycle. *Significantly different from Control group (2B).

4. Discussion

The data obtained in the present study indicate that there was an improvement in students' learning about the heart physiology after the use of the cardiac cycle puzzle in different real class conditions.

Considering that teachers play a fundamental role in developing the students' positive or negative regard for scholastic content, facilitating or hindering the learning process, respectively (Delors *et al.*, 1998; Leite, 2012), the use of active teaching-learning methodologies can help the development of positive regards of student for complexes themes studied in the professional education. Alternative methodologies can replace or complement traditional ones and both options can have positive effects on students' learning. In this context, it is also necessary that teachers are convinced that any new

methodology that they intend to introduce in their classroom routine is efficient in promote learning. Otherwise, it's hard to convince them to change their teaching practice.

If the evaluation about the efficacy of a teaching method is done in a real classroom condition, it will decrease artificial effects and bias. Different evaluation approaches, with advantages and disadvantages, are available and can be chosen accordingly the scholar schedules.

The use of pre- and post-test is one possibility for the evaluation of educational strategies (Barclay *et al.* 2011). In the present study it has been used in the study 1. As advantage it can be included in the class schedule without a significant increase in the class duration. Only the time for the application of the tests will be added. However, the limitation of pre- and post-test is that in the post-test, the students know the questions. Therefore it is not possible to conclude that the improvement in the grades obtained after the use of the educational game is only due to do the use of the game. Even so, the pre- and post-test can provide evidences about the efficacy of the educational method, and some changes in the questions' writing and/or questions' order decrease the bias.

In the studies 2 and 3, the students in the same course were divided in two groups and only one group performed the activity with the puzzle, while the others had a lecture (study 2) or read about the cardiac cycle (study 3). As showed by other authors, these approaches allow the comparisons between the uses of an educational game with a lecture (Rubinstein *et al.*, 2009) or reading (Cardozo *et al.*, 2016). And, in the study 4, it was evaluated the effect of the educational game in addition to a previous lecture in mixed classes with students from two different undergraduate careers. In the present study, the higher number of correct answers of the game groups in the tests evidenced that it increased the comprehension of students about the studied theme, in comparison to lecture or reading about the theme. In this way, the difference between the groups was the use or not of the educational game, decreasing the bias of pre- and post-test.

In summary, the results presented here showed that the educational game increased the students learning about the cardiac physiology, when it has been used for replacing and also for complementing traditional teaching methods, supporting the efficiency of educational games.

In conclusion, the present study supports the hypothesis that the use of active teaching-learning methods may increase students' learning, and show how the evaluation of the efficiency of such methods can be applied by the teachers, during the classroom routine.

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Pedagogies of Academic Writing in Teacher Education: from Epistemology to Practice and back again

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Abstract

This paper discusses barriers to the development of academic writing, in the area of teacher education in UK higher education . We first situate these issues in a higher education context increasingly defined by new technologies and diverse cohorts of higher education students. Drawing on empirical data obtained from interviews with both students and teachers (N=21), we then critically examine a range of perspectives on the definition, role and function of academic literacy in this contemporary context. Findings include useful insights into the development of writing skills and teacher identity, but they also reveal fundamental differences in the epistemological presuppositions of those teaching academic writing. These accounts are reflected in significant differences in pedagogy, and raise important questions for practice which, although potentially irresolvable, may help to explain some of the difficulties which emerge when trying to teach academic writing. Such fundamental issues, we argue, need to be at least recognized if teachers hope to develop the writing capacity of trainee teachers in an academic context.

Keywords: *Academic Writing; Teacher Education; Epistemology; Pedagogy.*

1. Introduction

A recent green paper from the UK government, *Fulfilling our Potential: Teaching Excellence, Social Mobility and Student Choice*, aims to reshape the higher education landscape with a greater emphasis on students' needs and quality of provision (BIS, 2015). These proposals have put the spotlight on the learner experience and teaching quality in higher education, one of the impacts of globalization.

This paper, accordingly, focuses on academic writing, which plays a central, if contested, role in the treatment of knowledge, indeed wider definitions of higher education (HE) study, as well as in provision and assessment of pedagogical quality (see, for example, Lea and Street, 1998; Rolfe, 2013). However, HE's continued dependence on certain writing conventions as an expression of academic ability and employment potential is open to question, as are the pedagogies related to the acquisition of the relevant skills – if indeed the practice of writing can be described in this way. Critics see the latter as reductive and a reflection of the inequalities heralded by globalization and neo-liberalization of higher education, (e.g. Badenhorst et al, 2015, Shay and Peseta, 2016). If higher education's ratio *essendi* includes contributing to the development of democracy, access and social justice (Badley, 2016), how far do academic writing pedagogies help or hinder this goal?

Some recent work on the topic has reiterated the need for a practice framework to develop academic writing (Lillis, 2003; Wingate, 2014; Cannady and Gallo, 2016). The goal is to develop pedagogies that prepare students for both academic and professional success while avoiding reducing the practice to the parroting of a set of skills and reproducing a status quo which perpetuates an anachronistically exclusive view of what higher education should be. We want to show in this paper, however, that such pedagogies must reflect the views of the teachers who implement them if they are to be successful, since teachers play an agential role in establishing, maintaining and changing things at the level of practice. The data presented below suggests that teachers' presuppositions define both what is taught as academic writing and how. To clarify these aspects of teachers' critical, epistemological and pedagogical perspectives, we look closely at how practitioners in the area of teacher education teach academic writing. Drawing on an empirical study, our findings indicate specific responses to the question of what academic writing means in this context and how it should be taught from the perspective of those who teach and indeed learn it. Our analysis identifies underlying themes and distinct rationales behind these choices, emphasizing the ultimate impact of these presuppositions on the student experience.

2. Method

A pilot study was first undertaken with two cohorts of students writing at masters level in order to establish hypotheses which were then discussed in a conference presentation. These informed a further study with respondents (N=21) who were professionally involved in teacher education. Semi-structured, face-to-face interviews of teachers and student were used to investigate our hypotheses: respondents were asked to define academic writing, explain why it was important, highlight barriers to the successful development of academic writing skills, and critically discuss writing pedagogies. Recordings were made and transcriptions added to notes made during the interviews for analysis.

It's notable that this cohort reflected a typical feature of teacher education in that many respondents were at the same time students, teachers and teacher educators, being involved in doctoral study alongside their teaching role. In the UK, it is common for practitioners to work in their teaching role while conducting further study in higher education at the same time. This includes HE lecturers, who may carry out their professional role, for example teaching academic writing to trainee teachers, while carrying out research for a doctorate. Each interview threw up individual issues pursued in other publications, but in this paper we'd like to focus on teacher education as arguably the key area in the debate mentioned above about how to develop pedagogies for academic writing in the current context. For this reason, we present three colleagues whose responses to the questions were both specific enough to recognize the variety in the ways academic writing is taught and learnt, and generic enough to suggest wider lessons for a pedagogy of writing in and for the university.

Odette (names changed for anonymity)

Odette is an experienced teacher educator who grew up outside the UK. For her, academic writing is "just another genre of writing". It is defined by certain rules and the existence of an identifiable community which respects them. It therefore reflects the demands of a literate society which prizes the written form and, therefore, differs from other genres only insofar as it is prescribed by an academic community and the rules that bind it. Odette felt no particular need to criticize or defend these prescriptions. This collective perspective, according to which writing conventions express a community of values, matters because it implies a particular purpose, content and even style of writing, she said:

It's also an attempt to create a genre that reflects a way of thinking, so the content is about thought, that is not just a personal narrative but has some kind of basis in other people's research, other people's thinking, sometimes in the thinking of recognized, knowledgeable people / gurus in the field.

Odette's views, she said, are already at odds with those in teacher education who prize "personal narratives" as a research resource. For her, academic writing is all about a shift from a subjective perspective to a more socially constructed one. She described this as forming a "net that holds things together" which is always produced by and with other people. At the same time, Odette recognized the irony in the fact that practices which bind a genre and its community also, as she put it, "keep people in their jobs". More importantly for her, though, the social nature of academic writing can be a distraction in that it tends to encourage a focus on consensual, stylistic aspects of text to the detriment of other, more difficult and perhaps more important issues of substance:

[This] keeps people worrying about how many references and things, how many commas etc (...) I wonder sometimes if it's because other issues are harder to grapple with. Harder to give somebody feedback on, and also harder to teach or, sort of, coach people at getting better at.

Speaking of her pedagogical choices, she felt that while examples are important, they must be "not too far beyond the level of where the students are now". Working on texts in groups can be helpful, particularly sharing examples of peers' writing. Focused "awareness-raising" work on specific vocabulary and sentence structure is useful, especially when English is a students' second or third language. But while there should be a focus on style as well as content, this should not eclipse the latter:

But I try not to so too much on "you're missing a comma"...I give much more feedback on "you haven't got your paragraph right" than I do about things like commas, because I think they are the things that are ignored, that [teachers] are afraid to tackle.

Beth

Beth is also originally from outside the UK. Currently working in teacher education, her professional role includes a focus on academic writing at Masters level (level 7 in the UK HE qualification framework). She felt that "the best academic writing is something you want to read", but her definition of academic writing differed from Odette's in its emphasis on logic and structure. Thus as a "logical way of putting forward ideas", it should be clear, well-structured and readable and follow certain established HE conventions. Its ideas should relate to the question or topic in hand, and should

“incorporate” the views of other theorists, suggesting that these were secondary in some way to what Odette called the individual’s own story. In addition, for Beth, students should also provide a critical account, which meant an essentially dialectic procedure of making sure the text was “relevant to the arguments for and against”. This was something that students should “hopefully” do, suggesting that, again, this aspect of writing was a goal rather than a criterion.

Like Odette, Beth felt that writing involved producing work defined more by its “higher quality” than “non-academic institutions”. She was not unusual in highlighting the circularity of this argument, and pedagogically, Beth was clear that support is needed:

It’s bit like learning to cook. If you’ve never read a recipe before, you’re a bit confused by what you’re supposed to do, and if you’re asking someone to make a four-course meal and they don’t know how to boil an egg, then of course it’s going to seem insurmountable.

Beth’s sensitivity to the challenges that one’s background might impose on the task meant that she felt that one-to-one support is “much better than having group sessions”, since individuals come with very specific issues which can’t necessarily be addressed in groups. The first thing is always to look at what they have written, and then show other examples which can make the penny drop. She insisted on the visual importance of being “able to picture it” in order to understand the structures, approaches and language required.

Part of the role of pedagogy, then, is to tackle the barriers to academic writing. The first of these, Beth felt, is the lack of pedagogy, in that academic writing is simply not taught at all in many cases:

It doesn’t tend to be taught, that’s the problem and so it’s held up as a sort of monolith to students as something they are supposed to achieve and they have no idea what it means or how to do it, so it’s actually quite frightening.

She first highlighted language as a big barrier, and the assumption in some students that what is required is “some kind of Dickensian English”. This is made more difficult, however, by what she calls the “pomposity of an awful lot of academics”, for whom writing is an “ego trip”. Beth was very critical of those whose stance on writing is dogmatic – proscribing first person subject pronouns was the example she gave – and recognized “brilliant academics” by their coherence and ability to articulate what academic writing is about without seeming pompous.

Fear of failure was also a barrier, apart from a lack of ability, which might come from having a background in other “languages” (maths, engineering for example). But an equally important problem for Beth is the potential threat to identity. Students from other cultures struggle with the conventions and norms, particularly those governing the kinds of relationships that are expected with teachers:

If they have grown up in a culture where the academic is put on a pedestal, an unattainable God-like figure, then again they don't actually think they'll ever be able to be like that. (...) I want to do this course, but I don't want to become like you. I don't want to become the sort of person that my family, my friends won't like.

Interestingly, she felt that support for learners with these barriers has to be more attractive to the learner if it is to be taken up. Unfortunately, she said, support is not always promoted in a helpful way by academics who, rather than help the learner, wash their hands of them:

Sometimes we say “go along there for study skills” (...) We tend to say, that's not my job, I'm an academic, I don't do study skills, there are people over there who do that.

Even when support has been provided though, degree-level qualifications are awarded even when writing skills are not up to the expected standard. Her conclusion was that “I think there's a lot of sloppiness out there”.

Bella

Despite similarities in some points, Bella's definition of academic writing differed fundamentally from both Odette's and Beth's. Rather than focus on the demands of a community or genre (Odette) or on the need to express one's own ideas (Beth), writing for Bella is more about working on “the body of knowledge that is out there”. Like her colleagues, Bella was well aware of the role of convention and the fact that writing can seem a rather self-justifying activity. For her though, academic writing is the ability to summarize, organize and contextualize the work of others. Bella's epistemological standpoint informs what she means here, since for her existing knowledge was to be “gathered” by the writer into “some kind of concise form”. This gathering involves transferring and translating, and tellingly focuses on reading as a source of information to be summarized.

Bella echoed the view that a challenge exists in teacher education for those qualified in subjects where academic literacy is not usually expected, making academic writing something of an alien practice. Teachers then often wrongly assume that everyone understands how to organize their thinking and thus the first step is to provide a “very easy recipe” for clarity:

Number one I give them a formula, and I always say I’m not after Oscar Wilde, I’m not after beautiful writing, I’m after clarity and I always say you’ve got to explain the what, the how, the why, the why not, the improvements and the limitations.

She also felt that explicit work on a range of others’ writing was helpful, focusing on students’ work (essays) to help identify strengths and weaknesses in the organization, in how the knowledge is presented, or in how quotes are being used. She asks questions about strategy (“was it an effective way of approaching it or not”), and “technical stuff” for example by providing deconstructed essays which the students reorganize in order to look for logic, successful threads and so on. Ultimately, though, for Bella, the approach should not be too prescriptive, because of the different needs of the different writers. This means “always letting them have a go”, providing plenty of practice and feedback which comments on content as well as on style, and the chance to develop both an individual “voice” and a set of practices that work. Both are emergent phenomena for Bella who, like Beth, felt that confusion was an important response to the problems of writing.

3. Discussion

Odette, Beth and Bella all show the confidence in describing their practice that one would expect from experienced teachers in this context. This suggests that little has changed in this regard since Lea and Street’s findings in 1998: teachers of academic writing tend to have clear but often contradictory ideas about what they are teaching.

This being said, fundamental differences in epistemological outlook marked these three accounts, suggestive of constructivist, social constructivist and realist presuppositions. Beth’s suspicion of the social context in which we learn to write leads her to take a constructivist stance according to which knowledge is built at an individual level. Only subsequently is it refined in the light of rational debate and, up to a point, in the face of institutional threat and the “sloppiness” she suspects exists in some situations. Her pedagogical choices follow this line, focusing strongly on individual support and expression. Odette’s social constructivist position contrasts with this, since for her knowledge and its acquisition are defined by essentially communal parameters. Her

preferred pedagogical activities reflect this outlook, for example in their focus on group work, shared texts and an eye for content expressed in an accessible way. All accept that the construction of knowledge relies more on communicability than on details of form. Bella's view, finally, differs radically from both the others in taking a more realist perspective according to which knowledge is "out there" to be processed by the writer. Pedagogically, her activities focused on the kinds of practice which would help the writer deal with the predictable confusion faced by the inevitable challenge of what is "out there".

These differences are interesting in themselves, and represent a healthy diversity in teachers' outlook. But they raise several questions for pedagogies of academic writing. First, are teachers aware of the epistemological presuppositions which underpin their pedagogical preferences? If so, how critically do they treat these presuppositions, and how aware are they of other perspectives? Second, are teachers conscious that their pedagogical choices may be driven by these epistemological presuppositions, and that this may limit the way they respond to learners' own more or less tacit epistemological expectations? Third, are teachers aware that close colleagues might have radically different views on these topics, and that these views may well differ radically from those the student has heard before? Do they know that advice, teaching and support may be completely different as a result?

4. Conclusion

Despite the technicist discourse of academic skills and criterion-referenced assessment, the teachers in this study show how individual epistemological assumptions, deficit discourses and institutional requirements play a key role in defining the details of academic writing pedagogies. Despite their similarities, as soon as the details are examined, we see important differences in how three colleagues actually go about teaching and assessing academic writing. These differences are a form of "discoursal dissonance" whose reduction, it has been argued, can empower students (Saunders and Clarke, 1997). Such dissonance within an individual discipline and between individual professionals may well have an impact on the academic's own development as they engage in writing for publication, but perhaps the most important question regards the possible impact of these differences on students and their work. Additionally, if teachers themselves find the decidedly non-textual activities of experience, experiment and observation most beneficial as applied learning activities (van den Bos and Brouwer, 2014), why do we continue to rely on academic writing as a vehicle for knowledge? What

is the future for academic writing whose pedagogies are based on the transmission of formal features with little or no regard for content, ideas or originality?

These questions may well reflect what Jean-Francois Lyotard (1983) calls a *différend*: a difference of opinion based on valid but fundamentally incompatible and conflicting premises. As such, academic writing is an ethical problem at the heart of today's academy. Perhaps, as Bella suggests, our task is to familiarize students with these potentially confusing differences. But unless teachers of academic literacy can address these questions, students may continue to see academic writing as pompous and confusing, undermining retention and success. In a context of rising student expectations and the spoonfeeding, pass-at-all costs culture (cf. Itua et al, 2014; Cahill et al, 2015; Masika and Jones, 2016) teachers risk adhering to plans which, while successfully prescribing the outcomes of central educational processes, remain a failure (cf. Hagström and Lindberg, 2013).

Acknowledgements

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An affordable and modular development environment for PLC- Training

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Abstract

This paper focuses mainly on educational programs in the fields of mechatronics and electrical engineering. Building, programming and testing electrical circuits with programmable logic controllers (PLC) is an integral part of practical final exams in this sector.

Keywords: *PLC-Programming, raspberry pi, Codesys, practical training in distance and e-learning-courses*

1. Introduction

In Austria as well as in many other countries vocational qualification programs are heavily subsidised by tax money. Those programs aim to increase the amount of skilled workers needed by the industry while decreasing the unemployment risk of the already employed individuals that achieved additional qualifications. This type of training mainly takes place at technical schools ("HTL", vocational schools) and other educational facilities managed by Austrian commercial institutions like the WIFI – represented by the chamber of commerce – and the BFI – represented by the chamber of labour. As the majority of all training programs are free, they almost completely rely on the aforementioned subsidies. This paper focuses mainly on educational programs in the fields of mechatronics and electrical engineering. Building, programming and testing electrical circuits with programmable logic controllers (PLC) is an integral part of practical final exams in this sector.

2. Goal

PLC training is mainly performed on the following systems due to their availability at training facilities as well as their wide spread use in the industry:

- Eaton Moeller Easy Serie 800
- Loxone
- Mitsubishi alpha
- Siemens Logo 8
- Siemens Simatic S7

Educational facilities offer laboratories in which the listed PLC systems can be used for the duration of an exercise. Unfortunately, it has shown that trainees mostly lack basic programming skills that in turn mean that they need intensive training in order to reach a level that allows them to successfully pass their final exams. For this reason, trainees often feel the need to work on additional exercises at home. This can be done using software simulating different types of PLC systems but in many cases, real hardware would be more adequate to improve effectively. Because of the usually high cost of PLC systems equipping trainees with the needed hardware normally is not a sustainable option. The following table lists the cost for both new as well as refurbished control units (the prices include only the control units and not any needed extension units).

System	New [€]	Used/Refurbished [€]
Eaton Moeller Easy Serie 800	290.-	80.-
Loxone	498.- ¹	n.a.
Mitsubishi alpha	170.-	40.-
Siemens Logo 8	140,--	90,--
Siemens Simatic S7-300	849.-	250.- ²

In addition to the control units proprietary software is needed in order to program, test and simulate a PLC workflow. Loxone offers the needed applications free of charge while Eaton-Möller, Mitsubishi alpha and Siemens Logo 8 only offer limited variations of their software on a free of charge basis (which would be still enough for training purposes). Unfortunately, Siemens' Simatic software is expensive and not available in free variations, which renders it not viable for additional training at home.

For this reason, the author tries to outline cost efficient alternatives that can be used to increase the amount of practical education for trainees.

3. Approach

In order to make it possible for trainees to work on additional exercises without the need of a laboratory it was necessary to find components that could be used in a way that stays close to the normal usage in the industry while staying affordable. The easiness to acquire the necessary equipment is another main issue.

The maker movement that established itself in the technical society during the last couple of years uses many components for home automatization, small-scale mechatronic projects and quite sophisticated electronical engineering endeavours while staying extremely cost effective. So-called single board computers (SBCs) are broadly used by this group and offer open computing platforms with very comfortable hardware access. SBCs like the Beagle Board and Raspberry Pi as well as simplified micro controller platforms as the Arduino are widely used and cheap enough for amateur usage.

The Raspberry Pi – a product produced by the Raspberry Pi Foundation in Great Britain – was developed in order to offer students an affordable computing platform for the use in

¹ For schools Loxone offers a 90% discount

² Since there are various models within this family prices can be higher

computer science and electrical engineering. Being well documented, affordable (the model 2 costs around € 30.-) and easy to integrate in a various array of projects the Raspberry Pi was chosen as a key element for the affordable training platform.

Using the SBC peripheral devices like switches, light emitting diodes, sensors and so on can be controlled via the programmable general purpose input and output pins (GPIO). Unlike other microcontrollers like the Arduino the Raspberry Pi can only sustain an output voltage of 3.3 V in contrast to an output Voltage of 5 V or 24 V which is more often used in the industry. The way in which to solve this will be outlined in a following paragraph.

As the Raspberry Pi is a fully functional computer (one of the reasons why the author favours it over the Arduino which is merely a micro controller) it can be used with different operating systems (OS). In this case Raspbian – a derivative of the Debian GNU/Linux distribution – is used as it is well documented, freely available, modifiable and compatible with a wide range of software packages. The OS is installed on a micro SD card using another computer or bought with a preinstalled OS image.

The SBC can be used to program automation tasks in different programming languages, environments such as C/C++, Python and JavaScript but as trainees in this field normally do not have computer sciences, and no substantial programming background another more suitable software environment had to be found. CoDeSys (Controller Development System) – developed since 1994 by the German company 3S Smart Software Solutions GmbH – offers a IEC 61131-3 conform programming environment which is compatible with the Raspberry Pi running Raspbian as well as very close to the development processes used by the most PLC systems. The development environment supports the following programming methods:

- IL (Instruction List)
- ST (Structured Text) – a programming language similar to Pascal
- LD (Ladder Diagram)
- FBD (Function Block Diagram)
- SFC (Sequential Function Chart)

Additional useful features included in the CodeSys development environment are an implementation of a continuous function chart – a SFC extension – as well as a powerful visualization tool that would be lacking in the software solutions offered by Eaton-Möller and Mitsubishi alpha. In the most cases trainees would have to solve problems programmatically using FBDs which during their final exams targeting one of the listed usual PLC environments. The transition from CodeSys to those platforms utilizing FBDs is easy because the programming environment strictly adheres to the standards and best practises. The strict implementation of normed automation workflows as well as the fact

that CodeSys can be used free of charge on an unlimited amount of development computers as long as it is not used in a productive commercial embedded systems context are of advantage for the goal of providing a cost effective solutions for technicians in training. In order to simulate, test and run the programs on a Raspberry Pi a CodeSys plugin is required. This adapted runtime can be downloaded free of charge and used without functional limitations for two consecutive hours at a time before it has to be restarted. Unlimited usage can be acquired through the purchase of a licence currently costing € 35.-.

As mentioned above the Raspberry Pi only offers 3.3 V output voltage at the GPIO-interface. In order to work with an output voltage of 5 V which is more widely utilized in the industry and is therefore more suitable when standard sensors and actuators are to be used. The easiest way in accomplishing this task is converting the GPIO-interface to the standard I2C bus. This is done using a special interface board provided by the German company Horter & Kalb shown in Fig. 1. Fig. 2 shows the interface attached to the Raspberry Pi.

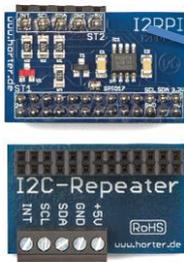


Fig. 2. I2C Interface for the GPIO

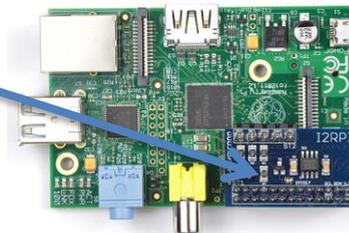


Fig. 1. I2C Interface attached to Raspberry Pi

Based on the I2C Bus Horter & Kalb offers the following modules:

Digital I/O-Cards

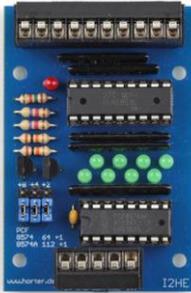


Fig. 3. Digital input card 8 bit



Fig. 4. Digital output card 8 bit

It is extremely helpful that the status of the inputs and outputs are signaled via low-current LEDs in order to help students to get a quick overview of the external connections.

Analogue I/O-Cards



Fig. 6. Analogue output card 12 bit



Fig. 5. Analogue input card 12 bit

All the five above-mentioned cards can be either bought as assembly kits or already assembled and fully tested. Buying the kits is a good idea, if the students should also train their skills in reading technical drawings and in soldering. Buying the kits also helps cutting the costs down.

For demonstration, purposes there are three more very convenient cards available.



Fig. 7. Simulator for 5 analogue inputs



Fig. 9. Simulator for 8 digital inputs



Fig. 8. Simulator for 6 different analogue values

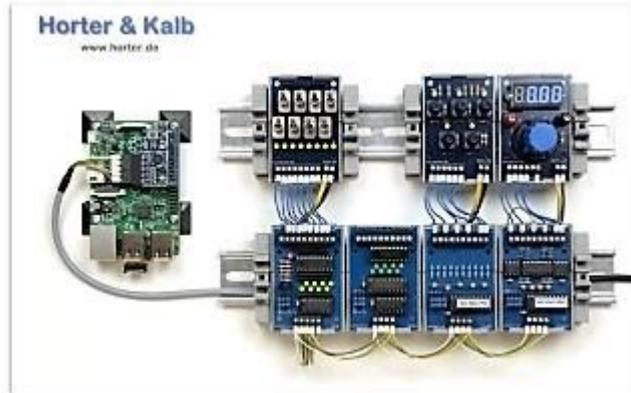
With the help of these cards, one can very quickly set up demonstrations for different input and output situations. There is no need that the students have these cards at home, because at home they have time enough to work with real signals at the analogue inputs and for instance with LEDs at digital outputs.

In a real industrial environment normally all components including the PLC are mounted on a DIN-rail. In order to achieve the normal look and feel, corresponding brackets are available at very moderate costs.



Bracket for DIN rail assembly

If you put all together to a working system, which behaves like a real system, it looks as shown in Fig. 11.



complete PLC system based on the Raspberry Pi

Although this system is a realistic model of a PLC controlled industrial environment, it has to be clearly stated that these components are not intended to be used in a real system due to the lack of robustness; however, for educational purposes they fulfil all the expectations.

Usage of the I2C bus also enables the usage of a special interface to be controlled via the USB-interface of a PC or Laptop. With this solution, it is possible to show the students the fact, that there are more ways to accomplish a given task.

4. Actual results

The author has used this type of development environment for training purposes since early 2016. As the desired outcome could not be measured yet – a meaningful metric indicating success would be an increased rate of positive final examinations for the training programs – scripts, slides, practical examples and the overall set up of the environment are still evolving constantly to meet the needs of trainees. In programs in which the environment was already used it has shown that about the half of all trainees already owned a Raspberry Pi SBC – making the platform even more cost effective – and those who were not familiar with it quickly adapted. Many participants also reported that they started using different components – if not the whole environment – to implement private automation projects. Working with CodeSys helped the trainees to better understand the logic of programming a PLC. Significant improvement of their knowledge in this field could be measured in several exams during the courses.

Regarding the transformation from knowledge achieved in this environment to professional usage it has shown that the acquired skills translate well to the most systems – only STEP7 for SIMATIC needs additional training as this system uses a lot of terms differently than they are trained using the new development environment.

In the meantime, it became more apparent that Codesys enters more fields within the automation industry. The newest member of this family are the new ASI-bus-controllers, which only can be programmed using Codesys and will therefore also be used during the final exams starting summer 2017.

5. Summary

In conclusion, the so far observed results offer promising prospects for the future. Participants have already given positive feedback and stated to be glad to have an affordable solution to gather experience at home. This solution will become especially productive when the time of intensive preparation for the final exams is due to begin. The trainees will be able to repeat exercises at their own pace and repeat relevant topics in order to prepare for their examinations. This offers much more available time for practice than under the current system where practical exercises can only be held during a view modules spent in laboratory environments.

As the system actively proves trainees that PLC projects can be realized on a relatively small budget and offers them the possibility to work on their own. It encourages them to play around with the different possibilities and have fun while learning exciting new technologies.

Being low cost this development offers great opportunities for schools and other educational institutions which normally operate on tight budgets and cannot make a lot of investments in technical infrastructure for additional laboratories and the refurbishment of already existing practice environments.

In preparatory courses financed by the participants without subsidies it would even be possible to outfit them with a set of their own which could be used in distance- and e-learning sessions which would have been unthinkable in programs where practical exercise is bound to laboratories. This would make it easier for trainees with packed working schedules to attend such programs.

6. Acknowledgment

I want to thank Mr. Horter from Horter & Kalb for the permission to use the photographs of the various cards.

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Horter & Kalb I2C cards for raspberry Pi: <http://www.raspberry-sps.de>

Horter & Kalb I2C cards: <http://www.horter.de/i2c>

Raspberry Pi: <http://www.raspberrypi.org>

Exploring PechaKucha in EFL Learners' Public Speaking Performances

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Abstract

The purpose of the study is to examine PechaKucha helps EFL Learners' to enhance their Public Speaking Performances and to explore useful information regarding the PechaKucha implementation as a learning tool. This study was conducted with sixty students at the University level. They were assigned into two groups randomly as experimental and control. The experimental teaching put into practice PechaKucha in accordance with public speaking activities. Meanwhile, the control group was given conventional speaking lessons only. To assess the performance the initial and post-testing by means of analytic scoring rubrics were used. In addition, a survey questionnaire was administrated to experimental group to examine their attitudes towards using Pecha Kucha in improving public speaking skills.

The results showed that the most number of students in the experimental group scored higher points than the control group. It can be concluded that the average performance of experimental group on the speaking public presentation skills posttesting increased in 10% comparing with that of the control group. Questionnaire's results reported that EFL learners in the experimental group mostly conveyed positive attitudes. This study recommended that EFL students need to be familiarized and trained with the use of PechaKucha technology into their EFL teaching.

Keywords: *Public Speaking Performance, PechaKucha, Rubrics, EFL.*

1. Introduction

Technology has changed the nature of instruction and learning. Teachers are exploring digital technologies to make learning more effective and engage students actively. Technology promotes socially active language in multiple authentic contexts due to its “accessibility, flexibility, connectivity speed and independence of methodological approach” (Gonzalez, J. A., 2009). More importantly with interactive web resources that provide the benefits of networking and real time communication the students can continue to learn the target language and enhance their cultural understanding outside the classroom (Bush M. D., 2007). The digital resources allow teachers to create new techniques, as well as reevaluate and improve the more traditional techniques that helps bring the target culture into the classroom. Methodologists argue that language learning should occur in a dynamic and active manner (Pitler H., 2006, Meadows D., 2003, Macquire J. 1998, Razmia M, Pouralib S, Nozad S., 2014). Technology-based activities together with an inquiry learning approach allow students to interact directly with the second language and its culture without time and place restrictions and to explore and construct a deeper understanding of target language cultural knowledge according to Ellis R. (1986), cited in Dema O., Aleidine J. (2012) a lot can be done with Powerpoint from creating basic presentations to photo albums, timed presentations with recordings, hyperlinked games and fascinating PechaKucha (PK). It is important that the research carried out by the GIAPEL group Villanueva, Ruiz-Madrid & Luzon (2008 and 2010) relied on the assumption that when “working with Web-mediated texts, students need to become wreaders and develop strategies which involve the integration of the reading and writing competence into a single wreading competence which means interaction with the text in all the ways for constructing meaning in a digital environment”.

Originally PechaKucha is the Japanese word for conversation or “chit chat” which was created by two architects in Tokyo who were tired of dreadful PowerPoint presentations. PechaKucha is designed to force speakers to prepare shorter, more creative, and more polished PowerPoint presentation. More importantly designing a PechaKucha presentation motivates speakers to think about their subjects in very different ways. A presentation is created using PowerPoint or any other presentation software. Presenters are only allowed 20 slides and those slides must automatically advance every 20 seconds thus the “20x20” label. Consequently, presentations should never be longer than 6 minutes 40 seconds because of this format, the PowerPoint slideshow must depend on visuals, rather than text-heavy slides. This is one of the best characteristics since speakers often abuse text in slideshows. Seeing PK facilitated by Jeremy Harmer at the 46th Annual International IATEFL Conference & Exhibition in Glasgow, Scotland, his presentations outstood having structure with a perfect introduction and conclusion and an internal structure clear main points, transitions that guided the audience through the slideshow. Hence the words and the

visual aid complement each other rather than just mirroring each other. Presentations are expected to be polished, professional, and engaging because of the time constraints, the auto-advancing slides, and the format, speakers spend more time planning and practicing their presentations as Scott Thornbury acted in his Youtube presentations “Exposure Immersion and Technology” (2015). Audiences are more likely to be engaged. Consequently, speakers need experience presenting their ideas in a short period of time and in a more creative, engaging way. Because of the short presentation, the audience should have plenty of time to ask questions and make comments about the presentation. PK mainstreams such language abilities as fluent speaking, public presentations skills, mastering computer assisted learning. Every ability in its turn has significant features which are necessary for students to perform brilliantly so that to be ready for professional endeavor and possess self-confidence and be assured professionally.

2. Methodology

2.1. Participants’ profile

Methodological basis of the research are integrated general and specific methods, including observation, study and synthesis of experience, questioning, experiment and critical analysis of scientific and methodical literature on the problem and statistical analysis. Firstly we learned information on fundamentals of PK: its history of development, ways of implementation and structural basis. The practical part of the research was based on designing lessons during 5 weeks and their realization in Kazakhstani English language classroom and then was presented an analysis of the experiment from the three sides: to the impact on speaking skills development, public presentations skills and average academic performance.

Our research was held in the Eurasian National University with the 2d year students of the speciality “Foreign Language: Two Foreign Languages” aged 19-20. There were 3 groups totally 60 students including 18 males and 42 females. Each group is divided into two subgroups due to the academic aptitude: subgroup “A” and subgroup “B”, 10 students in each. Subgroup “A” overall has the same marks and level of knowledge as subgroup “B”. The research was held in group “B” which called experimental with implementing PK while group “A” control has a traditional teaching approach. Students are quite united; they respect and value each other. The academic proficiency of the whole group is high enough. There is no evident leader in the class. However, there are a couple of girls who eagerly arrange all class activities and keep the students united. They are the most responsible persons who are ready to help with any arrangement. Overall the students are well-mannered. They do not unitize obscene language, at least, in teacher’s presence. At the lessons the part of the group is active and loud, another part is quiet silent. Teacher has to

make effort to arouse them from the indifference. Subject-matter of texts and assignments meet the students' needs and interests in compliance with claimed age. Majority of students have B1 level of English proficiency.

2.1. Pre-Experimental Procedures

The purpose of the PK project was targeted as to improve speaking fluency and coherence, to develop lexical and grammatical accuracy and make better pronunciation. The descriptors as fluency and coherence, lexical resource, grammatical range and accuracy, and pronunciation are used worldwide in assessing IELTS speaking results. We added Body Language as set apart descriptor for maintaining public performances skills. Body Language includes nonverbal communication, physical presentation and visuals (Appendix). So beforehand during the first week we observed the experimental and control groups, gave them survey questionnaires about their speaking skills in public and self-evaluation. Furthermore the initial test consisting of 2 sections was elaborated to analyze students' speaking skills in both groups. The checking was conducted during one academic hour at the first week, besides, in experimental and control groups were 30 students in each. So every descriptor counted in number of students according to their points of speaking descriptors. The results of the initial testing are illustrated in Tables 1 and 2.

Speaking Descriptors/ Points%/ Number of students	Fluency and coherence	Lexical Grammatical accuracy	Pronunciation	Body language
100-80%	8	10	8	7
79-60%	11	10	12	9
59-40%	5	3	5	7
39-20%	4	3	3	4
19-0%	2	1	2	3

Table 1. The Control “A” subgroup students’ public speaking initial test results

Speaking Descriptors/ Points%/ Number of students	Fluency and coherence	Lexical Grammatical accuracy	Pronunciation	Body language
100-80%	7	8	8	5
79-60%	9	8	10	8
59-40%	6	5	7	6
39-20%	4	5	3	7
19-0%	4	4	2	4

Table 2. The Experimental “B” subgroup students’ public speaking initial test results

As we can see in Tables 1 and 2 analysing the first descriptor – fluency and coherence – control group has better results as 8 and 7 (100-80%), 11 and 9 (79-60%), 2 and 4 (19-0%) correspondingly. Regarding lexical and grammatical accuracy also students from control group get higher points than experimental one: 100-80% points have 10 students in group “A” while only 8 students in group “B”. Besides 4 students from experimental group have the lowest results. Nevertheless, students with good pronunciation 100-80% and next points are observed in both group equally. Also, the number of students in control group in accordance with body language descriptor is slightly higher than in experimental one. Hence observing speaking initial testing results of control and experimental groups the highest points of all descriptors are occurred in control “B” group.

2.2. Experimental Procedures

Totally our experimental teaching lasted 5 weeks by reference to syllabus we had English lessons 3 hours weekly. In fact the experimental group “B” implemented PechaKucha in accordance with speaking activities. Meanwhile, control group “A” had parallel lessons

with the same topics on given conventional speaking lessons only. It was important for our experiment to have a complete picture of the positive and negative aspects of the PK using in classroom setting that's why results were assessed in the pre- and post-testing due to analytic scoring rubrics. Firstly, we explained PK characteristics and discussed its implementation at the English classrooms according to the syllabus during the first week. Moreover we introduced analytic scoring rubrics as an assessment. We started by doing a presentation ourselves about something that relates to our lifestyle. The students were encouraged to choose a topic which has personal significance to them so that the whole class could find out more about each other through the presentations. So the topics under experiment were "Art and Literature in Our Life", "Performance art", "Green issues". We provided examples as good online examples using official PechaKucha website at: <http://www.pecha-kucha.org/>. Then, during the second week we slightly increased the time for each slide and allowed longer presentations so that to prepare them to speak fluently and master public speaking performance and relieving a stress of speaking in public. At the third week we asked students to try to use a 'Pecha Kucha' format: 20 slides by 20 seconds which was more rigid but often more enjoyable. Next, we complicated tasks for students with taking their own photographs for the presentation, encouraging students to orally cite sources and providing audience handouts with full citations as a part of the assignment during the 4th week. The main purpose was to create interest in their topics among the audience and get students thinking critically and speaking relaxed about topics. This format was centered on the idea of audience analysis and, therefore, asked for speakers to think about the most critical components of the topic, the best way to visually represent the ideas, and the most interactive way to present the material verbally and nonverbally. Finally, at the 5th week we discussed feedback of implementation PK and the experimental group completed questionnaire and analysed scoring rubrics.

2.3. Experimental Results

Post-test was prepared using initial test structure, thus, it consists of 2 speaking parts in both groups so that to compare the improvement of speaking skills in public performances. In both groups were the equal number of students: 30. As it was mentioned above, the descriptors were as follows: Fluency and coherence, Lexical resource, Grammatical range and accuracy, Pronunciation, Body Language. In accordance with initial testing every criterion of the post experimental testing counted in number of students depending on their points of speaking descriptors. The results of the post testing are illustrated in Tables 3, 4.

Speaking Criteria/ Points%/ Number of students	Fluency and coherence	Lexical Grammatical accuracy	Pronunciation	Body language
100-80%	7	10	8	8
79-60%	10	9	12	7
59-40%	7	4	5	7
39-20%	4	3	3	4
19-0%	2	1	2	3

Table 3. The Control “A” subgroup students’ public speaking post test results

Speaking Criteria/ Points%/ Number of students	Fluency and coherence	Lexical Grammatical accuracy	Pronunciation	Body language
100-80%	8	10	9	8
79-60%	10	9	10	8
59-40%	6	5	7	7
39-20%	5	4	3	6
19-0%	1	2	1	1

Table 4. The Experimental “B” subgroup students’ public speaking post test results

As the Tables 3 and 4 denote there are differences between experimental and control groups regarding fluency and coherence on initial tests and posttests: according to 100-80% points in group “B” 7 and 8, in group “A” 8 and 7 correspondingly. But according to 39-20% points the number of students of the first descriptor in the experimental group – 4 and 5- is higher than in control – 4 and 5. The highest positive deviation is observed in experimental group regarding pronunciation improvement (100-80%, 19-0%) which is higher than in control group. Therefore, there is no significant correlation on lexical and grammatical accuracy in both groups. According to the Tables 3 and 4, less students of control group get points (19-0%) of body language descriptor.

But actually in comparison with the control group, the moderated average variance of the experimental group is higher in all descriptors. The results point out that all participants of the control group had made some improvements after the study but the improvement was not as big as the one made by the experimental group learners. The average variance of the experimental group was obviously superior to that of the control group showing that the PK technique could effectively enhance the public speaking performances of the students. Regarding the results of initial testing and posttest we can observe dynamics of the first descriptor as fluency and coherence through experimental group only: 100-80% - 7 and 8 students correspondingly, 79-60% - 9 and 10 students, 19-0% - 4 and 1. In addition, the

second descriptor as lexical and grammatical accuracy in post-test were 10 students with 100-80% comparing in initial 8 students, only 2 students get 19-0% instead of 4 in initial. Therefore, it can be concluded that the average performance of experimental group on the speaking public presentation skills posttesting increased in 10% comparing with that of the control group. The results showed that the students in the experimental group scored significantly higher than the control group. Additionally questionnaire's results reported that EFL learners in the experimental group mostly conveyed positive attitudes. This study recommended that EFL students need to be familiarized and trained with the use of PechaKucha technology into their EFL teaching.

3 Findings

The research focused on how to implement PK techniques in the classroom, describing its peculiarities, and explaining teacher roles and student tasks; therefore, this research gives a clear picture of how to integrate PK into University levels. Consequently, the new knowledge generated by this research can be implemented corresponding future educational policy. Firstly, in the practical part the results of the initial test in both control and experimental groups were presented. Secondly, the sequence of topics were generated using PK format have been created in the past to help educators achieve better learning outcomes on speaking skills in public performances and probed experimentally. Thirdly, the post-test was held and the findings indicate that the learners in the experimental group, initially having inferior results, noticeably improved performance according to traditional grading system and speaking skills criterion; the students in the control group have showed practically the same results as in initial test. As a result PK significantly improves students' speaking skills in public much more than the traditional way of teaching. Thus, the experimental results of students' performance confirm PK as learning tool can engage students in the practical environment. PK makes practice and training more engaging, diverse, and customized to their needs and challenges. Through the process of PK students can turn narratives into multimedia productions to develop their speaking skills fluently and act more assured. The technique of PechaKucha can be used effectively in Kazakhstani classroom setting to improve English language acquisition. What is more students from experimental group presented stories using digital images, photographs, video, animation, sound, music, text and a narrative voice boosted the positive motivating impression. Thus research has emphasized that using PechaKucha to communicate and to learn therefore involves being able to understand the new discourse practices for constructing new knowledge.

4. Conclusion

The innovative PechaKucha as new learning tool allows teachers to create and improve the more traditional techniques into the classroom. Based on the main aim of this research in investigating the peculiarities of PK and proving the effectiveness of using this technological tool experimentally in teaching a foreign language we summarise that surely PK is a significantly essential part of any English classroom focusing on the principle of cooperative learning in public speaking performances. This study contributes to new understandings of how to create authentic learning context that can be used in a range of educational settings. We would like to sum up with words that our research work is done in Kazakhstani classroom and its results have an important scientific significance and practical value for English teachers at any schools, University and language courses worldwide.

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Appendix

RUBRICS

POINTS	Fluency and coherence	Lexical resource, Grammatical range and accuracy	Pronunciation	Body Language
100-80%	*speaks fluently with only occasional repetition or self correction; hesitation is usually content-related and only rarely to search for language, • develops topics coherently and appropriately	• uses a wide vocabulary resource readily and flexibly to convey precise meaning, • uses less common and idiomatic vocabulary skillfully, with occasional inaccuracies • uses paraphrase effectively as required, • uses a wide range of structures flexibly, • produces a majority of error-free sentences with only very occasional inappropriacies or basic/non-systematic errors	• uses a wide range of pronunciation features • sustains flexible use of features, with only occasional lapses • is easy to understand throughout; L1 accent has minimal effect on intelligibility	Excellent posture with no swaying. Gestures are smooth and appropriate. There is no fidgeting. The speaker appears completely at ease.
79-60%	*speaks at length without noticeable effort or loss of coherence • may demonstrate language-related hesitation at times, or some repetition and/or self-correction • uses a range of connectives and discourse markers with some flexibility	• uses vocabulary resource flexibly to discuss a variety of topics, • uses some less common and idiomatic vocabulary and shows some awareness of style and collocation, with some inappropriate choices, • uses paraphrase effectively • uses a range of complex structures with some flexibility • frequently produces error-free sentences, though some grammatical mistakes persist	• uses a wide range of pronunciation features • sustains flexible use of features, with only occasional lapses • is easy to understand throughout; L1 accent has effect on intelligibility	Speaker usually maintains good posture, but may sway or lean on the podium. There is a small amount of fidgeting. There are a few gestures.
59-40%	• is willing to speak at length, though may lose coherence at times due to occasional repetition, self-correction or hesitation • uses a range of connectives and discourse markers but not always appropriately	*has a wide enough vocabulary to discuss topics at length and make meaning clear in spite of inappropriacies • generally paraphrases successfully, *uses a mix of simple and complex structures, but with limited flexibility • may make frequent mistakes with complex structures though these rarely cause comprehension problems	*uses a range of pronunciation features with mixed control • shows some effective use of features but this is not sustained • can generally be understood throughout	Speaker leans on the podium and/or fidgets. There was very little gesturing and/or movement.
39-20%	*usually maintains flow of speech but uses repetition, self-correction and/or slow speech to keep going, • may over-use certain connectives and discourse markers • produces simple speech fluently, but more complex communication causes fluency problems	*manages to talk about familiar and unfamiliar topics but uses vocabulary with limited flexibility, • attempts to use paraphrase but with mixed success, *produces basic sentence forms with reasonable accuracy, • uses a limited range of more complex structures, but these usually contain errors and may cause some comprehension problems	*uses a range of pronunciation features with mixed control • shows some effective use of features but this is not sustained • can generally be understood throughout, though mispronunciation of individual words or sounds reduces clarity at times	Speaker leans on the podium and/or fidgets. There is no gesturing and/or movement.
19-0%	*cannot respond without noticeable pauses and may speak slowly, with frequent repetition and self-correction • links basic sentences but with repetitious use of simple connectives and some breakdowns in coherence	*is able to talk about familiar topics but can only convey basic meaning on unfamiliar topics and makes frequent errors in word choice, • rarely attempts paraphrase • produces basic sentence forms and some correct simple sentences but subordinate structures are rare, • errors are frequent and may lead to misunderstanding	*uses a limited range of pronunciation features, • attempts to control features but lapses are frequent	Tension and nervousness are obvious and the speaker has difficulty recovering from mistakes.

Attitudes and attitude change of students towards the relationship between theory and practice

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Abstract

The present study examines the attitudes towards the relationship between theory and practice of students in the context of teaching-oriented Master's programs. The data are based on the project "intensity and stability of job-related attitudes in teacher training" (ISabEL), which was conducted at the University of Flensburg. The study analyses the change of student's attitudes towards the relationship of theory and practice during a practical semester. The attitudes were measured using a self-developed scale, which was developed on the basis of a qualitative reconstruction of Thon (2014). The results reveal that the contradiction between theory and practice tends to increase after the practical semester.

Keywords: *higher education; teacher education; theory practice relationship, attitudes.*

1. Introduction

Throughout the past decade, the nexus between theory and practice has gained increasing attention in higher education policy. One of the main driving factors for this recently renewed interest in the relationship between theory and practice has been initiated by the Bologna reform process and the formulated key goal of upgrading the employability of the graduates. Mainly the need to prepare students for the swiftly changing requirements of the global labour market in a knowledge-based society has demanded a shift to more practice orientation (Scott, 2003). Lately, the university-based teacher education in Germany has changed tremendously by the introduction of the so-called practical semester (“Praxissemester”) in almost every state (Bosse, 2012). Even if internships are exceedingly appreciated by teacher students (Makrinus, 2013) and although it is argued that bridging the gap between theory and practice needs to expose students with real classroom experiences (Zeichner, 2010), Arnold et al. (2014) have recently asserted a lack of empirical evidence about learning and professional devolvement of students in these new forms of field experiences in teacher education. Particularly in Germany empirically studies on the question of the unintended effects of field experiences that would help to “overcome the naive notion that internships have (quasi-)unlimited benefits” (Arnold et al. 2014, p. 17) are currently sparse. Furthermore, general attitudes of teacher students and especially changes in such attitudes based on practical experiences are still a desideratum, because studies have often examined domain-specific attitudes, especially on mathematics (overview at Fives & Gill, 2015; Reusser & Pauli, 2014).

2. Objectives and research questions

Against this background, the present study aims to examine new insights into the changes of attitudes of teacher students towards the relationship between theory and practice based on their practical experiences during the practical semester. Therefore, we can formulate the following research questions:

- (1) What attitudes towards the relationship between theory and practice have teacher students, and how do they change during a practical semester?
- (2) Does the practical semester bridge the gap between theory and practice?

3. Theoretical Framework

In research on teacher education, attitudes or beliefs have long been considered to be an important part of teacher competence (Baumert & Kunter, 2006). There are different definitions of attitudes as well as synonymous terms such as beliefs, ideas, subjective theories or value systems (see the overview in Calderhead, 1996; Pajares, 1992; Reusser & Pauli, 2014). Often the aspect of evaluation regarding an object is emphasized as an important defining characteristic. In a widely-used definition, Eagly and Chaiken (1993) define an attitude as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (p. 1). Because attitudes are regarded as value judgments, they may differ in terms of their valence and intensity. The strength of an attitude plays a decisive role in the variability of attitudes. Strong attitudes apply as being more stable and more resistant concerning changes over time. Moreover, it is likely that they regulate information processing and behavior.

4. Methods

This study is part of the longitudinal research project "Intensity and stability of job-related attitudes" (ISabEL), which is being carried out at the University of Flensburg since 2014. The project aims at measuring the change of job-related attitudes of teacher students in the context of academic and practical phases. It takes individual and institutional characteristics into account. The scale of the present sub-study is based on a qualitative study of Thon (2014) who has reconstructed three dimensions of the relationship between theory and practice of teacher students in a Bachelor's programme (1. practice orientation as a condition of comprehension, 2. application of theory to practice and 3. independence between theory and practice). The items were formulated in the sense of an attitude as an evaluative judgment. The survey covered a four-stage response format (Likert scale) with respect to the consent to the statements (1 = "not true" to 4 = "exactly true"). The dimensionality of the scale was tested in a preliminary study. The scale was part of a pre-post study within a 10-week internship (practical semester). Thereby the three-factor structure of the scale was tested again, using confirmatory factor analysis. The analysis was conducted with the program M-Plus. In accordance with the recommendations of various researchers, the present study used several fit indices to evaluate the adequacy of the specified model. In addition to the χ^2 -test, the fit indices CFI, RMSEA and SRMR are reported. The model evaluation was based on the recommendations of Schermelleh-Engel et al. (2003). The analysis of mean differences of attitudes toward the complexity of teaching was carried out using a t-test for dependent samples.

5. Data sources

The sample of the present analysis included the cohort of Master's students in the practical semester. This is implemented at the University of Flensburg for 10 weeks in the third semester of the Master's degree programs, for teaching both at primary schools and at comprehensive schools (lower secondary level). The first data collection took place in October 2014. Altogether 78.62% or 239 of the 304 student teachers participated in the questionnaire survey, carried out during an introductory session on the practical semester. At this time 47.7% of the teacher students were registered for the Master of Education program for primary school and 52.3% for the Master of Education program for comprehensive school. A total of 78.6% of the teacher students were female. During the second data collection in February 2015 233 teacher students (76.64%) were surveyed again. The survey was executed in an obligatory course of the practical semester.

6. Results

Table 1 shows the sub-dimensions of the scale "attitudes towards the relationship between theory and practice" with an item example for each dimension and the internal consistency for pre- and post-surveys. The Cronbach Alphas are between .67 and .87 and can be assessed as being acceptable to good. The specified measurement model for the scale has an acceptable model fit ($\chi^2 = 60.71$ [df = 41], $p = .02$; CFI = .97 ; RMSEA = .05 ; SRMR = .05) (see Figure 1). Almost all indicators load high on the three distinguished latent factors ($\lambda = .44$ to $\lambda = .84$). All indicators contribute significantly to the explained variance.

Table 2 presents the means and standard deviations of the pre-post survey and the results of T-test for dependent samples. For the first measurement point, the findings show average differences between the dimensions of attitudes toward the relationship between theory and practice. The highest agreement shows up for the dimension "practice orientation as a condition of comprehension", followed by the dimensions "application of theory to practice". The lowest mean value appears for the dimension "independence between theory and practice".

The results also reveal that two of three dimensions of the sub-dimensions significantly change within the practical semester in the direction of less approval for the dimension "practice orientation as a condition of comprehension" and for more approval for the dimension "independence between theory and practice". The effect size of the mean differences can be regarded as small effects (see Cohen, 1988). The effect is for the dimension "practice orientation as a condition of comprehension" is $d = .20$ and for the dimension "independence between theory and practice" $d = .10$.

Table 1. Sub dimensions of the scale “attitudes towards the relationship between theory and practice” and statistical values.

Subscale	Item example	α pre	α post
<i>practice orientation as a condition of comprehension (POC)</i> (4 items)	Practice orientation makes the theory clear.	.84	.86
<i>application of theory to practice (APL)</i> (4 items)	Theories have to be applicable.	.67	.70
<i>independence between theory and practice (IND)</i> (3 items)	Theory and practice are not the same.	.68	.70

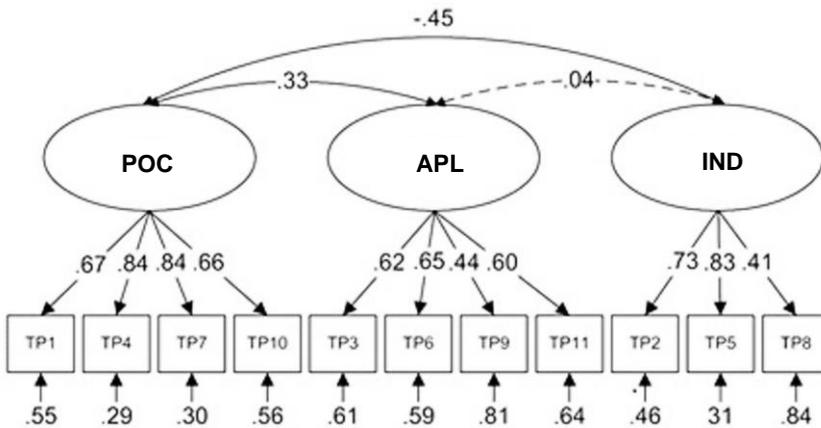


Figure 1. Three-factor-model of the scale “attitudes towards the relationship between theory and practice”.

Table 2. Mean differences in the attitudes toward the relationship between theory and practice

	M (SD) pre	M (SD) post	t (df)	Cohen's d
<i>practice orientation as a condition of comprehension (POC)</i>	3.50 (.54)	3.38 (.63)	-2.72 (223)*	.21
<i>application of theory to practice (APL)</i>	3.15 (.56)	3.20 (.57)	1.15 (176)	0.04
<i>independence between theory and practice (IND)</i>	2.19 (.67)	2.32 (.66)	2,46 (214)*	.10

7. Discussion

The present sub-study aimed to develop an instrument that can measure the attitudes towards the relationship between theory and practice, based on a reconstruction by Thon (2014). The postulated three-factorial structure of the construct is empirically detectable. For the specified model, acceptable model fit values could be determined. The analysis of the reliability showed adequate internal consistency for the three sub-scales. In the longitudinally pre-post study could be shown, that the attitudes of teacher students differ in a statistically significant manner between the measurement periods for two dimensions. The dimension "practice orientation as a condition of comprehension" significantly decreased while the dimension "independence between theory and practice" significantly increased in the post study. The empirical findings suggest that the contradiction between theory and practice tends to increase after the practical semester. Thus, we can conclude that the practical semester does not bridge the gap between theory and practice. Following the present findings, the changes in attitudes in the practical semester should be compared with different phases of the teacher education program. It should be proved, on which certain conditions these changes are dependent, or in what interaction they stand with selected individual characteristics of the student teacher.

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Financing Quality in Mexican State Public Universities

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Abstract

The policy of financing with extraordinary bidding subsidies as implemented by the Secretariat of Public Education (SEP) for Public State Universities (UPES) between 2001 and 2013 is analyzed. The results indicate that, with some regional differences, this form of distributing of Public resources has been effective by rewarding the Institutional Progress of those UPES in matters of quality, impacting their institutional processes of consolidation in a positive way, contributing to social equity through more and better educational spaces and diminishing the performance gaps between them during the period.

Keywords: *The Integral Program of Institutional Strengthening (PIFI); Public State Universities (UPES); equity and quality; higher education.*

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1. Introduction

The objective of this work is to analyze the impact of the financing policy of the SEP in the institutional progress of those UPES between 2001 and 2013; its incidence in the improvement of its educational quality and equity; and to contribute to the debate regarding the concerns of the country's UPES. To do that, a model that relates the bidding subsidy received by the UPES with their performance indicators are estimated and econometric exercise is performed. This allows an evaluation of the effectiveness of the SEP's policy in order to promote and motivate best institutional practices. The results achieved allow upholding that the model for assigning them has been successful in the attainment of its proposed objectives.

In the second part of this work the problem of financing higher education in Mexico is discussed, the different stages that have been traversed in their developmental process, as well as the different policies that the State has put in place. After that the methodology is presented and the handling of the information that has been used is described. In the fourth part the most important relationships between the strategic variables and the performance patterns, are analyzed for the IES's associated with extraordinary public financing carried out during the period being analyzed. Finally a reflection about the main findings arrived at during this herein research is made.

2. The discussion over financing public higher education in Mexico

The higher learning system (SES) in Mexico, between 1970 and 1982 had a phase of rapid expansion in its enrollment supported by a greater allocation of resources. This process allowed greater opportunities for access to a growing and diverse population, but at the same time characterized by an absence of policies that would give coherence to the educational system as a whole and for its negative impact to the quality of the majority of the educational programs of public universities (Muñoz 1988; Bruner 1994; Arizmendi and Mungaray 1994; Rodríguez 1995). Therefore a public debate was started regarding whether it was pertinent to continue supporting this sector within a context characterized by growing social need and scarcer economic resources. During the decade of the eighties, the recurrent economic crises in Mexico generated important budgetary adjustments to the SES that inhibited the growth from the previous years, and increases the gubernamental regulation and evaluation of the system.

As of the decade of the nineties one of the most prolonged and consistent efforts in the policies to reform higher education began. The internal and external efficiency of the institutions to obtain additional public funds, measured by the attainment of their education objectives and by the capability of their graduates to place themselves in the job market, became the central concerns of those very same IES's (Sorensen and Torfing 2011; O'Leary and Vij 2012). The contribution of those graduates to social mobility, the improvement of

income distribution and the social cost of providing finance to this sector, became topics of public debate (Mungaray and López 1996; Márquez 1999; Aguilar y Castañeda 2009). At the end of the nineties, through gradual changes there was an advance in both the organization of the SES and new institutional models; in the diversification of available programs; and in a growing connection between the educational, research, and private sector activities (Valenti and Mungaray 1997; De Vries 2002). Nonetheless, in a general manner, three fundamental challenges were being acknowledged for developing the SES: 1) To offer educational programs with quality and usefulness, accessible to all social groups; 2) Implement a new model for allocating extraordinary subsidies that would recognize and stimulate the educational quality; and 3) Achieve consensus for a State policy in matters of financing so as to promote the development of the sector for the long term (ANUIES 2002).

3. Methodology and Data

With the purpose of evaluating the allocation model of extraordinary subsidies that were under bid between 2001 and 2013, one econometric exercise was carried out. This measures the effectiveness of the financing policies to timely reward the universities' progress in the subjects of educational quality and equity. If the resources up for bidding are distributed favoring the institutions that show the greatest degree of progress in the performance indicators, it is an indication that the model has been functional and successful. Therefore

$$Y = \beta_0 + \beta_1 X_1 + \dots + \beta_n X_n + u_i \quad (1)$$

where:

- Y represents the proportion of PIFI resources delivered to the UPE's in relation to the national total for each of the years considered (2002 to 2013).
- $\beta_1 X_1 + \dots + \beta_n X_n$ include the information of the institutional performance indicators of the UPES's (see Table 1).
- u_i is the stochastic term of the model.

Table 1. Quality and equity variables for measuring the institutional performance of UPE's.

Variable	Academic competitiveness indicators	Definition
Quality	TPLEC	Total number of quality bachelor programs of each UPE/ Total number of bachelor programs that are subject to evaluation.
Equity	TMLEC	Total enrollment for the UPE quality bachelor/ Total enrollment for bachelor that are subject to evaluation.
Quality	TPNPC	Total number of programs in the PNPC (International competence, consolidated, in development and of recent creation) of each UPE/Total number of programs in the PNPC of the UPE's.
Quality	ET	Terminal efficiency (this information was taken as it appears in the SES electronic website (SEP, 2006b).
Quality	TCAC	Total number of consolidated academic bodies in the universities/ Total number of academic bodies (Consolidated, in consolidation and under formation).
Quality	TPROMEP	PTC number with a desirable PROMEP profile of each state's study institution / PTC total
Quality	SNI	PTC number that belongs to the SNI / PTC total

4. Analysis and discussion of the results

The allocation of the extraordinary subsidies through the PIFI as the instrument for evaluating and rewarding the progress of institutions of the UPES between 2002 and 2013, indicated in the first place that the proposed models show the positive signs that were expected of the coefficient of the explanatory variables (see Table 2).

Table 2. Econometric results of the PIFI allocation model on the basis of performance by the UPES 2002-2013.

N	Dependent variable	Constant	Independent variables				R ² Adjusted	Statistic			
			F	n	A						
1	Pifi ₂₀₀₂	C	TPLEC ₂₀₀₂	TDOC ₂₀₀₂	ET _{97_02}	0.4808	11.190	34	5%	1%	
	t	0.01568	0.0268	0.0274	0.0080						
2	Pifi ₂₀₀₃	C	TPLEC ₂₀₀₃	TCAC ₂₀₀₃		0.5133	19.585	34	5%	1%	
	t	4.655	3.023	1.557	1.100						
3	Pifi ₂₀₀₄	C	TMLEC ₂₀₀₄	TSNI ₂₀₀₄		0.6213	28.072	34	5%	1%	
	t	0.0191	0.0408	0.1211							
4	Pifi ₂₀₀₅	C	TMLEC ₂₀₀₅	TPROMEP ₂₀₀₅		0.4765	16.017	34	5%	1%	
	t	8.203	4.879	1.720							
5	Pifi ₂₀₀₆	C	TMLEC ₂₀₀₆	TCAC ₂₀₀₆		0.5721	23.058	34	5%	1%	
	t	0.0058	0.0452	0.0627							
6	Pifi ₂₀₀₇	C	TMLEC ₂₀₀₇	TCAC ₂₀₀₇	TPNPC ₂₀₀₇	0.8295	54.497	34	5%	1%	
	t	1.440	6.401	2.157							
7	Pifi ₂₀₀₈	C	TMLEC ₂₀₀₈	TCAC ₂₀₀₈	TPNPC ₂₀₀₈	0.8345	20.856	34	5%	1%	
	t	1.033	4.723	1.142							
8	Pifi ₂₀₀₉	C	TMLEC ₂₀₀₉	TCAC ₂₀₀₉	TPNPC ₂₀₀₉	0.8571	66.990	34	5%	1%	
	t	-0.0064	0.0418	0.0304							
9	Pifi ₂₀₁₀	C	TMLEC ₂₀₁₀	TCAC ₂₀₁₀	TPNPC ₂₀₁₀	0.8528	48.806	34	5%	1%	
	t	-0.0074	0.0442	0.1453							
10	Pifi ₂₀₁₁	C	TMLEC ₂₀₁₁	TCAC ₂₀₁₁	TPNPC ₂₀₁₁	0.8120	36.631	34	5%	1%	
	t	-1.147	4.765	3.305							
11	Pifi ₂₀₁₂	C	TMLEC ₂₀₁₂	TCAC ₂₀₁₂	TPNPC ₂₀₁₂	0.7160	21.795	34	5%	1%	
	t	-0.0152	0.0402	0.0604							
12	Pifi ₂₀₁₃	C	TMLEC ₂₀₁₃	TCAC ₂₀₁₃	TPNPC ₂₀₁₃	0.8059	46.658	34	5%	1%	
	t	-3.217	5.964	3.284							
	t	-0.0150	0.0402	0.0604							
	t	-3.259	6.104	3.365							
	t	-0.0121	0.0376	0.0540							
	t	-3.058	6.657	3.506							
	t	-0.0474	0.0405	0.0265							
	t	-3.156	6.665	2.752							
	t	-0.0368	0.0497	0.0459							
	t	-2.196	5.360	3.193							
	t	-0.0468	0.0326	0.0293							
	t	-1.927	2.900	1.648							
	t	-0.0217	0.0466	0.2541							
	t	-3.254	5.893	6.177							

Source: of our own making with information from the SEP (2006a, 2006b, 2014), UNAM (2014) and Rubio (2006).

In general they show a high statistical significance, and they have an acceptable adjustment flexibility that ranges from 43.4 to nearly 86 per cent. This contributes overall evidence that the SEP has efficiently used the special resources to promote the strengthening of the competitiveness and academic capabilities indicators of the UPES, with the purpose of improving the quality of higher education in México.

In second place, the econometric analysis also shows a differentiated behavior by the federal authority. For example, between 2002 and 2003, the quality of the bachelor programs offered by the UPES determined in an important way the levels of allocations that these received. This can be verified upon observing their individual statistical significance in relation to the other variables of equations 1 and 2. For the years 2002, 2004 and 2005, the progress of the IES's in strengthening their teaching staff's with more Ph.D. in their PTC, with SNI and PROMEP profile, were rewarded through the subsidies.

For the period that runs from 2004 to 2013 at least two behavior patterns can be observed. In the first place, a sustained phase of the bidding funds distribution linked to progress in the field of education equity, growth of enrollment in the quality programs, and the strengthening of the universities' consolidated academic bodies (CAC). Even though between 2002 and 2005 the CAC's had a moderate impact due to a lack of significance in their statistical t, as from 2006 its relevance becomes stronger as a determinant factor in the distribution. According to the SEP (2006a), this was due to that until the year 2001, team work at the universities was carried out around the educational programs and very seldom considering the common research interests, so SEP implemented integration work-shops of academic work-groups to plan and develop the CA's in the PIFI's, emphasizing that the main area for a CA should be the innovative generation and application of knowledge.

Between 2007 and 2013 a second phase is identified where beside educational equity and the strengthening of the CA's, the quality of graduate programs becomes relevant in the distribution of extraordinary funds. Equations 6 and 12 include the progress of the UPES's in this concept with more robust results in terms of its statistical significance and power of adjustment, which are coherent with the policy implemented by the federal authority starting from 2008. This allowed the linkage of the PIFI with the PNPC of CONACYT in its two aspects: the Quality Promotion Program (PFC) and the National Graduates Registry (PNP), through assistance that have a direct impact upon the improvement processes of the graduate programs of the UPES's.

5. Final Remarks

The results of this study confirm that public policies of extraordinary public financing towards the UPES's during the analyzed period, have generated significant positive impacts upon the processes of quality consolidation and a decrease of the institutional inequalities of the UPES's. This is because between 2002 and 2013, in general the PIFI has rewarded in a timely manner the progress shown by the UPES in the field of their institutional performance.

The quality of the educational programs of undergraduate and graduate levels that the UPES offer, as well as the advances in the field of educational equity in undergraduate programs were the indicators with greater relevance for the determination of the amounts distributed by the federal authority. In regards with the graduate programs, these results are consistent with the policy and the changes implemented by the SEP as from 2008, because until before this year the PIFI had only indirect impacts on the graduate educational level of the IES's. The public policy has been able to link the PIFI with the PNPC of CONACYT through supports with direct impact upon the improvement processes of these level of programs.

Regarding the incidence of the special funds for the generation of best institutional practices, it may be said that the progress achieved by the UPES is explained in good measure by the degree of subsidies they obtained in a competitive manner between 2001 and 2013. That becomes clear when performance levels of the UPES are compared with the allocations received over the long term, because their most evident and robust progress has been attained in the sphere of quality and equity of the bachelors programs that they offer. At the end of the period, UPES have accredited the greater part of their bachelors programs and increase the opportunities to access it, assuming upon the premise that for an educational opportunity to allow social equity, it must be of an accredited quality.

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University and Enterprises Linkages for Regional Development in México

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Abstract

This article evaluates the incentives to Mexico Innovation Program (PEI), from a regional perspective based on its contribution to the Regional Innovation System (RIS) of Baja California, between 2009 and 2013. Through the both additional behavioral and networks methodologies, the decision making process at companies, and the level of linkages among them, higher education institutions and governmental actors of the RIS is analyzed. The results show that by imposing the financing of innovation projects on the linking of business and scientific actors, PEI is helping to strengthen the RIS, encouraging 15% of its interactions.

Keywords: *Regional Innovation System, Evaluation Program Innovation Stimulus, Scientific Policy, Business Innovation, Regional Development in Mexico.*

1. Introduction

In 2009, the implementation of the Incentives to Innovation Program (PEI) in Mexico started, fostering the linkages among companies that seek to be more competitive through improvements in their processes and products, with Higher Education Institutions (HEIs), promote learning and major changes within the organizations that interact, as well as impacts on the Regional Innovation Systems (RIS).

In 2009, Calderón (2009) evaluated the first edition of the PEI, with an emphasis on design but without considering the regional aspect. In 2013, the National Council for Evaluation of Social Development Policy (CONEVAL, 2013) evaluated the PEI at national level between 2011 and 2013, with results not fully attributable to the intervention of the PEI.

To evaluate the impacts at the regional level, this paper analyzes the PEI during the years 2009 to 2013, in the Mexican state of Baja California. The objective is to know the impacts on the companies that have participated in the program and how they are reflected in the RIS, through the creation of networks of knowledge between the beneficiary companies and the scientific and technological structure that supports innovation. The centralized structure of PEI resources promotes that each region looks to capture the greatest possible benefits, to strengthen specific aspects of its development (FCCYT, 2006).

With the objective of demonstrating that the PEI contributes to the strengthening of the IRS by encouraging projects that broaden the interactions between the actors, first section review the background of the program and the literature on the characteristics of RIS and the economic advantages of the interaction Network that gives rise to the dynamics of innovation. The second section presents the behavior additionality and social networks methodology as pertinent to study the behavior and interaction of companies and HEIs. Results analysis is done, with emphasis on the interactions and connectivity of the networked system. Finally the conclusions are developed, highlighting how and to what extent the PEI contributes to the system connections.

2. Background

Tax incentives in Mexico are born under an initiative of the Mexican Association of Applied Research and Technological Development (ADIAT), to increase private investment in national research and development (R & D) and stimulate its link with HEIs. The program did not generate the expected results and since its inception it has undergone significant sub-exercises and concentration in large, mainly multinational companies, which in 2005 accounted for 60% of the requested incentives. Its greatest weakness was the laxity with which considered R & D projects was defined. This allow that in many occasions they supported marginal or developed innovations in other countries (OECD, 2010).

In response to recommendations from the Organization for Economic Cooperation and Development (OECD), the Secretary of Finance and Public Credit (SHCP) decided to cancel the program in 2008 and implement a new one that only supports projects that have a significant impact on R & D in the country; set a ceiling on resources for large enterprises; and conduct a comprehensive annual program evaluation (OECD, 2008). In 2009 the PEI is implemented with complementary economic incentive. The beneficiaries were all Mexican companies registered in the National Register of Scientific and Technological Institutions and Companies (RENIECYT) that carry out activities related to Research, Technological Development and Innovation (IDTI) individually, or in association with HEI and / or Centers and research institutes (CIs).

The IEP is composed of three subprograms: INNOVAPYME complements with public resources the investment in IDTI of micro, small and medium enterprises. INNOVATEC encourages investment in IDTI of large companies. PROINNOVA fosters the flow of knowledge between business actors of both sizes with HEIs and CI. This latest encourages the creation and permanence of innovation networks or strategic alliances for the development of projects in precursor fields of knowledge, that are translated into products, processes or services of high added value, with regional, sectorial and social impact. All modalities allow companies to have new patents, products, processes or services that improve their competitiveness and thereby promote the competitive advantages of each region or entity.

Table1. Amounts of PEI Support for fiscal year 2013

		Percentage of support for eligible project expenditure in fiscal year 2013			
Modality	Size of the company	Individual project	Project in connection with HEI/RC		Maxium support limit per company
		% Company spending	% company spending	%HEI/RC spending	Total (mexican pesos)
INNOVAPYME	MIPYMES	25%	40%	80%	21 million
INNOVATEC	Big Companies	22%	30%	75%	36 million
PROINNOVA	MIPYMES	N/A	65%		
	Big Companies		40%	80%	27 million

Source: Own elaboration with PEI data.

3. Literature Review and Methodology

The innovation system approach is a recognition that innovation ceases to be an isolated fact to be a social construct with visible economic effects, where knowledge-creating institutions previously not recognized by the market, actually facilitate the transit of the innovations they produce towards the firms where they are applied (Nauwelaers, 1995). The constant interaction between supply and demand generates a process of feedback, since part of the supply is increasingly influenced by the demand for knowledge, to incorporate it in the different spheres of the economy, generating an interactive learning between the different actors involved in the production and exchange of knowledge. A network vision allows to know the ways, channels and means in which the different members of the system make exchanges in the regions, based on the social capital and the existing institutional capacities.

In recent years, the regions and companies have been reconceptualized, due to the fact that, due to globalization and the opening up of markets, the increase in competition has generated a restructuring in the roles played by each one. The debate focuses on the internal capacity of the company to adapt to the new changes, seeking to improve its ability to innovate in the production process, or its ability to access new markets and produce new, improved and redesigned goods (Maskell and Malmberg, 1999). The second focuses on the economic success of some regions and their increase in the specialization of international trade, so that rather than focusing on individual enterprises, it does so in productive systems in which companies operate with external links and relations (Lawson, 1999).

An innovative territory becomes a primary source of resources for the decisions and actions that makes possible, and is characterized by the presence of a specialized production system, where a good part of the companies make efforts of technological innovation. Learning territories reflect the potential capacity of local actors to creatively mobilize existing resources as a product of the accumulation of knowledge generated by private,

public, educational and research institutions, to foster specialized business and regional partnerships (Rozga, 2006).

Different works have contributed to the understanding of the effect of R & D expenditure on the United States economy (Griliches, 1979), the importance of the geographical proximity of the actors in the capture of the use of technological externalities that arise mainly from universities (Jaffe, 1989, Anselin et al., 1997). In Spain, Baumert and Heijs (2002) show that the innovations of the Spanish regions are positively dependent on the innovative effort made on the technological size of the enterprise, the degree of innovative culture and the existing cooperation. Alberdi, Gibaja and Parrilli (2014) in estimating the connectivity of Spanish RISs, identify that asymmetric behaviors that generate different system failures and justify the design of exclusive measures for correction in each observed region.

In Mexico, evaluating the fiscal stimulus program through a sample of firms Santos (2006) finds that firms presented additionality by developing important organizational capacities, but also generated learning to select their projects and organize them better to reduce times and costs. Ruiz (2008) discovers that the entities with the greatest capacity for innovation have been those where economies of agglomeration are observed and where the state has contributed to the formation of innovative inputs. Casas and Luna (2001) review the processes of building networks of knowledge potentially favorable to innovation at the regional level, based on public strategies and collaborative actions of HEIs, concluding that although the spaces of innovation are built in the geographical proximity of the actors, they can reach regional, national and even international dimensions, depending on their level of connectivity.

The concept of additionality justifies the intervention of the state to provide the necessary amount of investment that stimulates innovation projects, in the case of market failures that inhibit investment by imperfections in the capital market. The interaction and articulation of agents within an RIS, recognizes market failures as obstacles inherent in the innovation process itself (Heijs, 2012). However, government leverage can go beyond compensating for the low level of private sector R & D investment, looking for changes in the behavior of agents to interact more and better (Larosse, 2001).

The effect of the PEI within, the companies with the methodology of the additional behavior is reviewed in a first moment, and then the analysis of social networks is applied to specify the level of interaction between the companies and the HEI and CI in the regional space (Lundvall, 2005).

A database of the period between 2009 and 2013 was constructed with the PEI minutes of the State Evaluation Subcommittee (ESS) of the Baja California, Mexico, considering the projects approved in each of the calls, which gives a total of 157 Projects. The ESS reviews

whether the projects submitted are relevant and meet the criteria of quality, implementation and impact, to be evaluated by three experts selected from the Register of Accredited Evaluators.

To identify levels of additionality, information was obtained from a sample of 63 beneficiaries, designed with a confidence level of 95%, to which an electronic survey was applied for each project. Although the counterfactual analysis allow us to examine whether the reaction of the firms is related to the PEI public policy or other unobserved factors, the network analysis was choose to identify levels of connectivity and centrality in the relationships, interactions, choices and structures built by the individuals and organizations to which they belong, making social capital prevail over human or individual capital (Wasserman and Faust, 1994). To do this an adjacency matrix was constructed to identify the relations between the actors, which was processed in the program UCINET 6 through the graphical construction of the network.

4. Results

The indicators of additionality

Investment: 61% of the projects had been operated with or without government support, wich indicates that public policy contributes 39% to the implementation of innovation and development projects, that are mainly related to the strategy of long-term innovation.

Vinculation: The 157 projects added 189 links, which allowed representatives of 72 percent of the projects to improve their perception of linkage. This has led them to establish lasting relationships; facilitating the exchange of knowledge; generate more innovative and higher quality products; and rethinking processes that help a more efficient production.

Participation of Researchers and Students: 72% of the projects had the support of some researcher and the rest were carried out with the own staff of the company. The main outcomes were three researchers per project, with variations from one to 12 and with a total of 111 researchers participating to carry out studies, specific analyzes or the use of laboratories. 58 percent of the projects involved students: 18 graduated from bachelor's degree, 17 master degree, and 5 from Ph.D.

Competitiveness: 51% of the projects obtained at least one new product as a result of the research, with a range between one and 23; and the spillover effect within the company by new ideas for improvement in other products, generates a synergy that usually has major effects. A new process within the company can have at least two effects: raising the level of productivity, modifying and improving the way things were done, or generating a level of saving man hours or less use of some input.

The indicators of the network

The system consists of 62 companies, 18 universities and 6 research centers (14 local and 10 foreign), for a total of 82 actors. The group of companies consists of three categories: 35 micro and small, 15 medium and 12 large.

The total number of connections that the PEI could generate in the period 2009-2013 are 7,656. Of these, 65% are between companies, 10% between HEIs and 25% between companies and HEIs. Given the operating rules of the PEI, which does not encourage connections between companies, the total number of possible connections is reduced to 2,679, and consequently generated a connectivity index of the Baja California RIS of 15%, with 382 connections of the participating actors in the PEI. Within the reasons that a company has for choosing a link with an educational institution, are the trust, reputation, specialization and speed to formalize the link.

The actor with the most connections in the network is the state public university UABC, with 80 connections, which places it at the center of the innovation system. It highlights the case of Honeywell with 14 and Syworks with 13 connections. More connections mean more confidence and generate more possibilities of future relationships with new actors within the network.

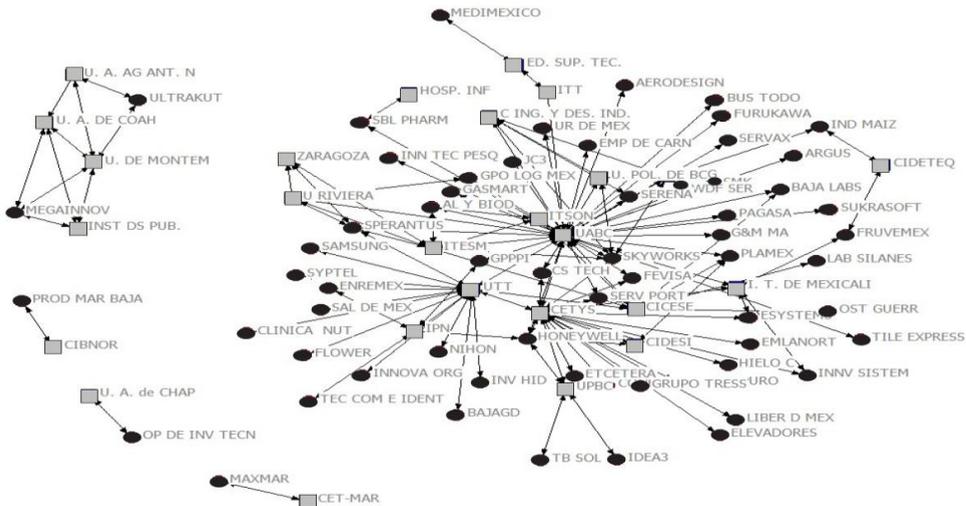


Figure 1.- Analysis of RIS Connectivity
 Source: Own elaboration with PEI data.

The UABC has a high degree of intermediation, with 36%, placing it in a position of actor bridge, with more control of information, communication and relationships between actors. With a correct strategy, this can grow in the short term. For a country like Mexico, it is very significant that a state public university (UABC) has the highest degree of intermediation

within an RIS. In the absence of connection between companies, it can be the strategic bridge of processes of connection between them, since it is the largest space where the demand for innovation of companies is concentrated.

Table 2: Nodes intermediation in the Network

INSTITUTION	NUMBER OF NODE PAIRS ABLE TO CONNECT	% OF INTERMEDIATE DEGREE	KIND OF INSTITUTIONS*
UABC	3,467	36%	PUHEI
CETYS	1,787	19%	PRHEI
UTT	1,607	17%	PUHEI
SKYWORKS	437	5%	COMPANY
HONEYWELL	349	4%	COMPANY
CICESE	331	3%	PURC
UPBC	288	3%	PUHEI
I.T. DE MEXICALI	252	3%	PUHEI
UAG	200	2%	PRHEI
IPN	180	2%	PUHEI
ITESM	158	2%	PRHEI
REST INST.	146	4%	THE REST

Source: Own elaboration with PEI data.

Note: PUHEIS, Public Higher Education Insitutions; PRHEI, Private Higher Education; PURC Public Research Center

5. Concluding remarks

Although a good percentage of the projects had been carried out even without government support, compared to the results of Mungaray, López and Moctezuma (2013), there is an improvement in the results of the program, since the percentage of projects canceled from failure to receive government support, rose from 18 percent to 39 percent. Similarly, the subsidy received by the companies, changed the perception of the linkage and the diversification of the links, motivating the projects to invest more and be more productive. The annual evaluation process guides companies to achieve better results, either through modification of their projects or suggestions for improvement, or through monitoring and evaluation of results as a whole. Although social arbitration is a practical way for knowledge to become a support to the competitiveness of companies, its acceptance by the business sectors accustomed to not arbitrate its decisions, has been slow but possible, thanks to the link with academic sectors, whose projects and products are always refereed.

From a construction perspective of RIS in Baja California, PEI contributes to companies maintaining their long-term technological trajectories, as it is well known that they are the first projects to be sacrificed in the face of investment or market uncertainty, are the long time projects, while the short term will projects continue even without government support. A second immediate impact is seen in the improvement of the capacities of human capital

thanks to the expansion of cooperation networks with other companies and with HEI and CI, which undoubtedly generates long-term synergies. When a company is selected as part of a government support program to develop R & D, has positive impacts on its image, increases its reliability and sends signals of solidity and innovative activity.

The PEI provides the same opportunity for access to the network, both for large and small companies, matching opportunities and benefits of belonging to them. The structure of the network is open, since new relationships can be created in each call, although the relationships can be repeated if a new collaboration is presented. In fact, this policy is solving a coordination problem inherent in an RIS, as the network encourages both the demand side of companies and the supply side to HEIs, inhibiting in both the natural aversion to cost and risk of generating new partnerships.

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Facilitating epistemological access by developing students experiences of undergraduate research

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Abstract

Quality supervision at undergraduate level provides the impetus for students to complete their research projects successfully and to progress to higher levels of postgraduate studies. Yet very little work has been documented on developing students' experiences of undergraduate research in preparing lecturers to empower students for postgraduate studies. Proponents of undergraduate research claim that quality supervision enables students to engage with their own research project; develop higher-order research related skills such as critical thinking; to plan and organise their research work in real-world settings; and to develop problem-solving and analytical skills. Fundamentally these capabilities can be applied to professional practice, thereby enabling students to be better prepared for a knowledge-based economy, which is a national imperative in the higher education research agenda. This paper assessed the epistemological access of undergraduate students in terms of developing their research potential. A case study research design within a qualitative framework was used. Census sampling was used (n=20). Data were collected by means of focus groups and students' reflective reports, which were thematically analysed. Overall, the salient features of this paper showed that students' described the teaching of research as the theory and the supervision of research as the practice, which assisted them in developing their skills, abilities and dispositions to make informed decisions and to self-manage their undergraduate research projects and practice.

Keywords: *epistemological access; undergraduate research; Quality Management; Dental Technology*

1. Introduction

Several authors (Armstrong & Shanker, 1983; Council on Higher Education, 2013; Howitt, Wilson, Wilson, & Roberts, 2010; Lopatto, 2004; Reynolds & Thompson, 2011; Spronken-Smith, Miroso, & Darrou, 2013) allude to undergraduate research being the bedrock of postgraduate research, particularly in terms of ensuring that there is a supply of future researchers to be recruited and trained for a more demanding postgraduate trajectory. They suggest that undergraduate research can be measured in terms of three broad categories, namely: institutional context; nature and quality of supervision; and characteristics of the research student. While a vast body of literature exists on the students' experiences of postgraduate research (Bitzer & Albertyn, 2011; Buttery, Richter, & Filho, 2005; Council on Higher Education, 2009; Lee, 2008, 2012), less evidence exists about developing the students experiences of engaging with undergraduate research in preparing lecturers to empower students for postgraduate studies. This is significant in the context of the increasing proportion of undergraduate students from previously disadvantaged backgrounds with limited experience of undertaking independent research work (South African Survey of Student Engagement, 2010). Arguably, the research project at an undergraduate level is more likely to be the first time a student is expected to adopt an autonomous role as a researcher, which is different from their previous experiences where their work is driven mainly by their lecturer. The challenge of framing a research idea and the successive re-drafting is truly new for undergraduate students, especially as they are expected to make the transition to an independent mode of study.

2. Aim of the study

To assess epistemological access to develop students' experiences of undergraduate research. It is worth noting that this study responds to the key strategic drivers of the Durban University of Technology (DUT), where this study was undertaken is to be a student-centred and an engaged institution by seeking new knowledge through its research and teaching. In particular, the study seeks to understand the students experiences and to build research into the undergraduate curriculum (Durban University of Technology, 2015)

3. Research Methodology

Higher education scholars (Healey, Jenkins, & Lea, 2014; Healey, Jordan, Pell, & Short, 2010; Howitt et al., 2010; Lee, 2008; Mainhard, van der Rijst, van Tartwijk, & Wubbels, 2009; Nulty, Kiley, & Meyers, 2009) indicate that embedding research knowledge and skills within the undergraduate curriculum strengthens students' undergraduate research experiences. This study therefore used a case study research strategy (Remenyi, 2013) to aid an in-depth exploration into developing student experiences of undergraduate research.

This approach is associated with qualitative research as it aims to holistically “understand the case in depth, and in its natural setting, recognizing the complexity and its context” (Punch, 2014, p. 120). The participants involved were the Degree of Bachelor of Technology (B Tech) students from two different programmes at DUT in Durban, South Africa. In particular, the 2014 students (n=10) registered for the subject Project 401, which is part of the B Tech in Quality within the Operations and Quality Management programme in the Faculty of Management Sciences and the 2015 students (n=10) registered for the subject Research Methods and Techniques I, which is part of the B Tech in Dental Technology programme in the Faculty of Health Sciences. Permission to collect data was obtained from the Institutional Research Ethics Committee (IREC). Ethical clearance and permission to conduct the study was obtained from DUTs Institutional Research Ethics Committee (*IREC Number: 102/15*). Informed consent was obtained from the participants prior to commencement of the interviews. The focus group interviews were audio recorded, and anonymity and confidentiality were maintained by using pseudonyms. Interview data were inductively analysed using the principles of thematic analysis. Students’ feedback on research training workshops, together with their research output, maintained the trustworthiness of the data.

4. Findings and Discussion

There were primarily two recurring themes, namely: the various teaching methods helped develop students’ understandings of research (*Figure 1*); and the positive attributes of the supervisors contributed to a constructive and effective learning environment (*Figure 2*).

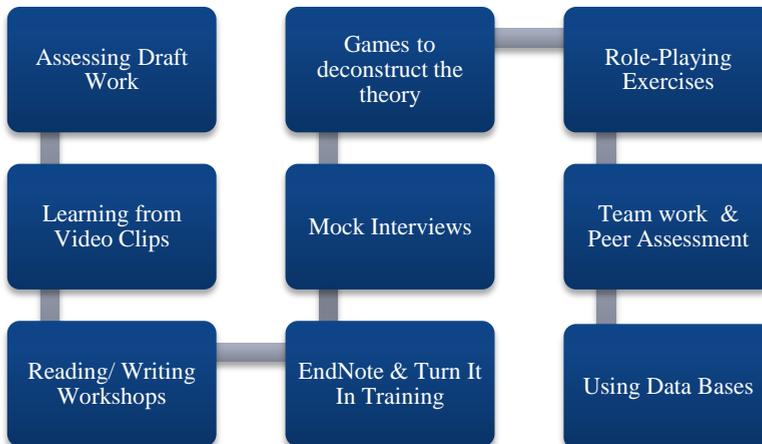


Figure 1. The various teaching practices helped develop students’ understanding of research.

Generally, undergraduate research is the first level at which students’ access and acquire knowledge on the various research discourses, particularly towards becoming a researcher. Students positively conveyed that “...teaching is like the theory part and the supervising is

like the practical.” Essentially, the various teaching methods enabled students to acquire their learners that is the theoretical ‘*know-why*’ knowledge to access and acquire the research discourse. Supervision, by contrast, is the license to apply the practical ‘*know-how*’ knowledge of research. Equally important, students declared that “*the lecturer showed support for all the students’ during data collection by accompanying everyone to their different facilities, which is just caring*”. Another critical point that deserves mentioning is that “*...she encouraged us and said, no, you can do it... even over e-mails she encourages us to still carry on when I wanted to give up.*” They also prominently emphasized that the lecturer was “*...always available ... going to the extent of setting all these devices and technology up so that they can assist the student, that just shows me that the person is approachable.*” In terms of good supervision, she encouraged us “*... to push our boundaries and raise the standards...*”, thereby enabling them to develop skills to critically evaluate and apply evidence-based arguments in their research reports. Evidently, students’ interest and active engagement with their individual research projects was significantly shaped by the positive attributes of their research supervisors. These findings are consistent with Azila-Gbetor, Mensah, and Kwodjo (2015) and Woolderink, Putnik, van der Boom, and Klabbers (2015).

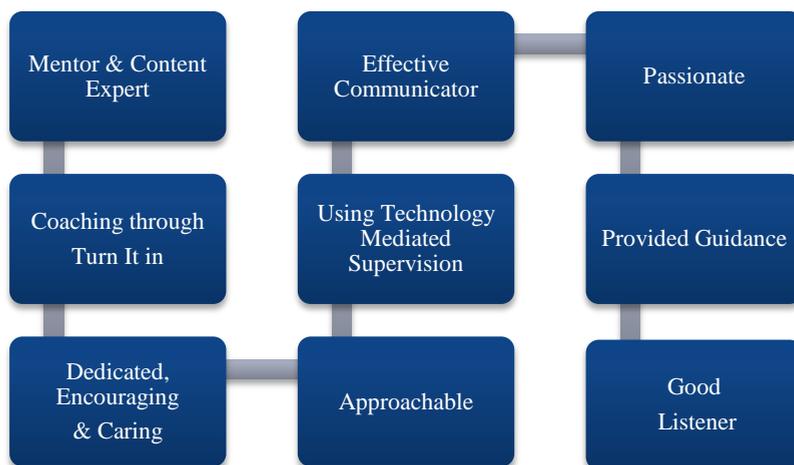


Figure 2. Positive attributes of the supervisors contributed to a constructive leaning milieu

Interestingly, students recommended that the teaching styles presented in Figure 1 “*...be introduced in diploma years as it will greatly prepare the student for what to expect at a B-Tech level and will also motivate them to further their studies to a postgraduate level.*” This adds support to the Quality Enhancement project that aims to move DUT to become a student centred university through the transformation of teaching and learning and the promotion of quality enhancement (Durban University of Technology, 2015; Sattar &

Cooke, 2014). This aligns with the South African higher education agenda of preparing graduates for a more knowledge-intensive economy (The Presidency: Republic Of South Africa, 2012). Some of the students also critically pointed out that having joint supervisors was discouraging “...because one was with you 100% of the time and while the other was there 50% of the time...”. This will be considered in the future supervision of undergraduate research projects. Finally, students’ unanimously expressed their gratitude to their “...supervisor for her continuous commitment and encouragement and the training that she given us all and all the efforts that she’s made...you’ve actually opened our eyes to a whole new world of reading reports and understanding that stuff”.

5. Conclusion

The improved understandings of students’ reported experiences have positively impacted on the development of two undergraduate modules for the new four year Bachelor of Health Sciences degree in Dental Technology. Particularly, the modules Introduction to the Principles and Practices of Research (*Level 3*) and Fundamental Principles and Practices of Research Design and Methodology (*Level 4*). In terms of the Bachelor of Quality degree students developed their knowledge in the modules Project (*Level 4*) and Continual Quality Improvement (*Level 4*). Further research to legitimise students’ experiences of undergraduate research is yet to be conducted through the sociological lens of the Legitimation Code Theory (Maton, 2014), specifically the dimension of Semantics.

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New pedagogical configurations for traditional learning tools: a proposal

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Abstract

Digital technologies have changed the world dramatically and, as a consequence, higher education is undergoing significant teaching and learning transformations based on their use. The need to plan and produce disruptive innovations for traditional learning tools brings a challenge in this sense. One of these modern pedagogical perspectives is the use of transmedia storytelling in education, which has given a new configuration to instructional tools and have changed their forms and educational function. We present a proposal of specialized vocabulary in reproductive biology of plants using the principles of transmedia storytelling. The design of an educational transmedia artifact for the particular terminological entry of the term «polinizador» is shown to illustrate the proposed structure for the vocabulary. This artifact is constituted by diverse resources made with the use of different media and is based on the use of tags linked to each resource, which allow interactive navigation between them, structuring the storytelling about the selected term. Each resource adds particular information on the definition of the term, so that the student can obtain the answer he needs. Transmedia storytelling allows the students' interaction with resources in a way consistent with their own interests, making them the center of their learning.

Keywords: *Transmedia storytelling; educational artifact; specialized vocabulary; disruptive materials; knowledge space.*

1. Introduction

The advent of digital technologies has changed the world dramatically and higher education is undergoing significant transformations as a result of technological innovations. The way higher education is taught and students learn is changing and this change will be enhanced by the integration of new tools and pedagogies that engage students. Newest ideas focus on the production of disruptive materials that comply with student-centered pedagogy (Adell & Castañeda, 2012; Fullan & Langworthy, 2014). In this sense, new pedagogies emerge around the use of ICTs in education and seek to exploit their full communicative, informational, collaborative, interactive, creative and innovative potential within the framework of a new culture of learning (Veletsianos, 2010; Adell & Castañeda, 2012).

In the midst of all these transformations, education has begun to take into account new communicative ways such as transmedia storytelling. This concept was introduced by Henry Jenkins in the world of communication in 2003 and since then we have switched from using terms like «multimedia» and «interactivity» to terms like «transmedia» and «convergence» (Jenkins, 2008; Scolari, 2013). Now, each media contributes part of the story and it is the «convergence» of the information contained in each one that creates the whole; each media is used «to do the best it can do» (Scolari, 2013) using different systems of meaning and language: verbal, iconic, audiovisual, interactive, etc. The «culture of convergence» is characterized by «liquid» contents that «flow» through multiple media and by the migration of audiences, who are no longer «loyal» to a particular media but to their own informational interest (Jenkins, 2008; Campalans, 2015).

Thus, in higher education context, transmedia storytelling has given a new visual and audiovisual configuration to the instructional image, which has changed its forms and its educational function with the evolution of digital technologies (Azzato 2015a). The contents developed in different media allow to generate «educational artifacts» (Azzato 2015a) that offer other possibilities for reading and understanding these contents, because transmedia storytelling has no order or direction, which allows the student to interact with its components in a personal way to build each one's meaningful learning (Azzato 2015b; Campalans 2015). Knowledge is produced through multiple interconnections and in different ways in each student, according to their own interests and skills in the digital world (Azzato 2015b; Campalans 2015). Thus, in knowledge built on a transmedia basis, students' understanding and involvement with respect to content may be enhanced by the diversity of media used.

According to these modern pedagogical perspectives, the need to plan and produce new learning tools in higher education is mandatory and disruptive configurations for traditional educational tools bring a challenge in this sense; dictionaries, or vocabularies in the case of terminologies, are one of these cases. In this work, we present a proposal of designing a

specialized vocabulary using transmedia storytelling; the design of an educational transmedia artifact for the particular terminological entry of a term is shown to illustrate the proposed structure for the vocabulary.

2. Design of the educational transmedia artifacts

Each educational artifact for terms in the vocabulary will be designed using the principles of transmedia storytelling: 1) Existence of a global message for each artifact, that will be the particular definition of the term. 3) Use of various media, devices or languages to design different resources in order to show with each of them one independent story, which converges with the other resources to articulate the global message; that is, the stories narrated by each one of the developed resources must add up for the understanding of the definition of the term; each resource will be done with different applications and will include videos, sounds, texts, images, etc. 3) Finally, and perhaps the most important, each resource developed to be part of the educational transmedia artifact should allow students to make further progresses in the search for new information according to their interests, because each resource should be open for student's active participation.

To explain the design of one educational artifact, a terminological article, we will use as example the term «polinizador» from the *Specialized vocabulary in Reproductive biology of plants* (Raimúndez-Urrutia, 2012).

2.1. Terminological article for the term «polinizador»

Information contained in the terminological article for the term «polinizador» is shown in Figure 1.



Figure 1. Elements of the terminological article for the term «polinizador».

The terminological article consists of three main parts: term, definition and complementary elements. Both the term and the definition will appear on the website *VocEs* (<https://www.voces.proyectos.usb.ve/es>), from which there will be access to all the terms in this vocabulary. The term will be accompanied by its grammatical gender and will be the link that connects the term page in the website with the transmedia artifact. If the definition includes other terms that are also collected in the vocabulary, these will be links to their corresponding page on *VocEs* and, hence, to their corresponding transmedia artifact. Finally, the complementary information will form part of the educational transmedia artifact; it has texts in which the use context of the term can be verified, related terms that will also be links to their pages on the website, and the English term, linking to texts in this language and which will allow also the codification of texts in English.

2.2. Educational transmedia artifact design

The educational transmedia artifact designed for «polinizador» is shown in Figure 2.

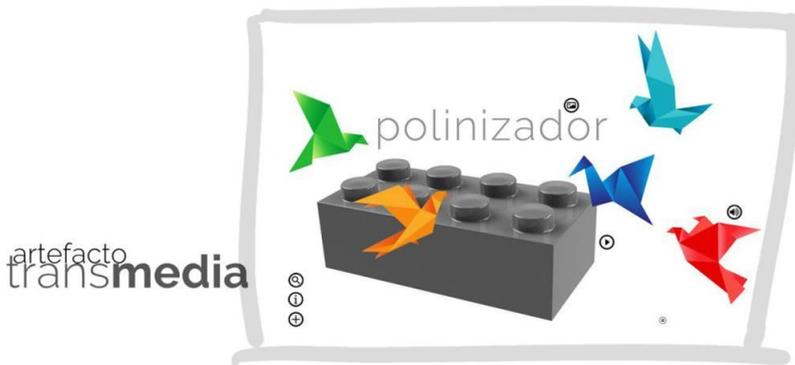
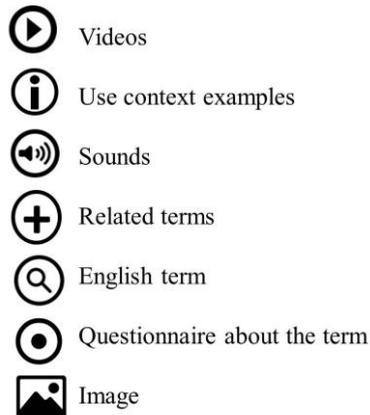


Figure 2. Educational transmedia artifact for the term «polinizador»

<http://www.genial.ly/5765847ff095e647d8dc8122/polinizador>

The educational artifact was created using Geanily's online software from *Genially web S.L.* (<https://www.genial.ly/es>) which allows the development of interactive and animated content. It is based on the use of labels or tags linked to different media (rich media tags), which allow interactive navigation between the media that will structure the storytelling about the selected term. The tags link to:



Each of these tags has particular characteristics depending on the media and the platform used to transmit the information, and all of them as a whole make up the «knowledge space» (Azzato, 2015b) for the term, through the interactions that the student establishes with the resources and among them. The student will be able to navigate between resources according to his criterion or interest, so as to obtain the necessary information to construct the answer to the learning question. The digital educational resources for each of the terminological articles may be developed by teachers themselves, although other open digital sources available on the internet, as a corpus of educational resources, may also be used.

Finally, all the educational transmedia artifacts designed for specialized terms in this vocabulary will be joined in the site *VocEs: Vocabularios de Especialidad* under the title *Vocabulario de especialidad en Biología reproductiva de plantas*. This vocabulary, in turn, will be part of an entire educational transmedia supra-artifact that will be developed for the subject *Biología reproductiva de angiospermas*. In fact, the educational supra-artifact would begin the storytelling in the classroom, face-to-face with the students, which is where the theory supporting the vocabulary is taught. As a whole, the site *VocEs* looks to collect specialty vocabularies for all teaching subjects in the Universidad Simón Bolívar, as another level of educational transmedia supra-artifact.

3. Discussion

The traditional educational tools, such as dictionaries or vocabularies of specialty, must adapt to existing demands in terms of teaching and learning in the new formal and non-formal spaces in higher education. This arises the need to plan and produce new learning and communication tools that can be used in the different portable devices with which students are currently accessing the information. However, the new pedagogical approach cannot simply be a substitution of technologies, but must be based on a new vision of learning (Adell & Castañeda, 2012; Fullan & Langworthy, 2014). In this sense, transmedia storytelling, as a new pedagogical approach, allow us to develop a disruptive configuration for a specialty vocabulary used in higher education, which will be web-based to create a more attractive and complete tool for today's students.

The contribution of emerging technologies should allow a different interaction between students and content (Adell & Castañeda, 2012; Fullan & Langworthy, 2014; Campalans 2015). With them, the teacher can create expectations about new and interesting things that students must discover, assimilate and integrate to actively build their learning. In this proposal, learning starts in the classroom, but then expands through all new media available, among which are educational artifacts designed for the terms of the specialty. Therefore, they should be intercommunicative, face-to-face and virtual spaces that open up in the hyperconnected world to offer areas of dialogic learning, intercultural socialization and collective knowledge construction (Azzato 2015a).

Tagged images will be part of the learning spaces for the terms of specialty. Tags constitute the space of knowledge and the knowledge will be shaped by the assembly that the student makes of each of the contents that have been tagged multimodally (Azzato 2015a; b). New digital applications for the management of images allow the incorporation of tags with which different resources, developed with and to different media, are identify. The educational transmedia artifact will be materialized from a tagged visual image, which gives form, instructional function and social meaning to the educational content, the terms, from visual and audiovisual narratives represented in different media and platforms that will perform, through the exchange and interaction in different social contexts, the construction of knowledge (Azzato 2015a). The tags help the student to identify the type of resource and to select those most meaningful to him and, thus, to begin the construction of the story that will allow him to understand the corresponding term.

In this way, an active attitude of the student, analyzing and selecting the resources that would make him know the message, will be necessary because he will be able to move between resources according to his affinity for them. This attitude must also be translated into feedback to those stories and to a relationship with other students who are also consuming that contents. This instructional methodology promotes the development of a

"transmedia thinking" (Azzato 2015b), which, as a cognitive tool, will allow the student to develop skills to decode, codify, organize, structure and relate concepts, elaborating their own visual speeches on a certain content (Azzato 2015a; b).

Connection to information and knowledge networks will be another social fact in the scenario of the convergence culture (Azzato 2015b; Campalans 2015) that can be promoted by transmedia storytelling. In this way, these vocabularies will have two approaches: the lexicographical, traditional, approach and a playful, connectivist approach that will allow students to elaborate their own visual speeches and, thus, their knowledge about the terms, according to their own mental processes of learning, using the new learning approaches and digital media.

4. Conclusion

The project *VocEs* proposes a new model of lexicographic tool for higher education, in which information and communication technologies are used along with new educational approaches. These new approaches take into account users, i.e. students and their characteristics, not only in terms of new forms of learning, but also in the use of mobile devices with which they access information. One advantage that this proposal may have is that each educational transmedia artifact corresponding to a terminological article of the vocabulary can contain as much information as is necessary to achieve the definition of the term, since, in addition, links to the internet make available a corpus of visual or audiovisual resources that could form the educational artifacts developed for the terms. Images, along with the tags they include and the associated resources, represent educational transmedia artifacts that can be in turn, linked with other educational artifacts to construct supra-artifacts, i.e. a no limits knowledge space.

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Liberalism and race equality in higher education: The shift from the mandatory to the persuasive

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Abstract

This paper examines a twenty year period to explore the salience of race equality in higher education in the UK. While research evidence accumulates to demonstrate that staff and students from minority ethnic groups continue to experience considerable disadvantage, universities throughout the period have typically remained remarkably complacent. Such complacency partly stems from the dominance in the academy of a liberal as opposed to radical perspective on equality. Universities typically see themselves as liberal and believe existing policies ensure fairness and in the process ignore adverse outcomes and do not see combating racial inequalities as a priority. The paper distinguishes two ideal typical approaches, the 'mandatory' and the 'persuasive' to the promotion of race equality and suggests that the period has witnessed the transition along a continuum from the mandatory to the persuasive. Regardless of which approach is preferred, universities are urged to have no truck with a deficit model and to see it as their responsibility to take action to ensure more equitable outcomes.

Keywords: *Equality and diversity; Race and ethnicity; Higher Education; Educational policy*

1 Introduction

What initially prompted us to address the issue of race and higher education was the murder of a young black man, Stephen Lawrence in 1993 because of the colour of his skin. The subsequent flawed police investigation eventually led to an official inquiry chaired by Sir William Macpherson. The report published in 1999 was extraordinarily damning: ‘The [police] investigation was marred by a combination of professional incompetence, institutional racism and a failure of leadership by senior officers’ (Macpherson, 1999: Para 46.1). And the political response, as exemplified by the Home Secretary’s response to the report, was equally forthright: ‘In my view, any long-established, white-dominated organisation is liable to have procedures, practices and a culture that tend to exclude or to disadvantage non-white people’ (Straw quoted in Pilkington, 2011:3). The acceptance by a senior judge and leading Minister of the charge of institutional racism was unprecedented and inaugurated what one of us has labelled ‘a radical hour’ when the state seemed to be serious about promoting race equality (Pilkington, 2014). The advent of the Labour government in 1997 and the subsequent publication of the Macpherson report provided a jolt to the sector. Renewed impetus was given to equality initiatives and the limitations of equal opportunity policies in generating cultural change and combating racial disadvantage were more widely recognised.

This paper surveys the two decades since 1997 to examine how the higher education sector in general and one university in particular has addressed race and ethnicity. It will draw upon a growing research literature to evaluate the major policy initiatives. We shall argue that the salience of race equality which rose dramatically in the aftermath of the publication of the Macpherson report, and the government’s response to it, has not been sustained. While new policy initiatives periodically emerge, what is remarkable in my view is the failure of the higher education sector in the last twenty years to transform the experience of Black and Minority Ethnic (BME) staff and students. Racial disadvantage remains stubbornly persistent, as we shall see.

2 The increasing focus on race equality

For a brief period in the first few years of the new millennium, the state exerted considerable pressure on universities to address race equality. Universities were cajoled to address race equality through two strategies for higher education, notably those concerned with widening participation and human resources. The first sought to promote equality and diversity in the student body, while the second was concerned with promoting equal opportunities in staffing. In addition to these colour blind strategies, the state also for a period required universities along with other public organisations to develop race equality policies and action plans following new race relations legislation in 2000.

One of us has evaluated these initiatives at length elsewhere (Pilkington, 2014) and therefore we will be succinct here. Colour blind government strategies to widen participation and promote equal opportunities had minimal impact in combating racial disadvantage. By contrast, the more targeted Race Relations (Amendment) Act s had more impact, at least in the sense of generating race equality policies and plans.

We need to be circumspect, however. Even when legislation had insisted on the production of race equality policies and action plans and guidance had been provided to aid the production process, the requisite policies and action plans were often initially lacking, and significant pressure had to be exerted to ensure minimal compliance (John, 2003). The reviews that formed the basis for my evaluation perforce focused on documents, but there is a danger being too reliant on documents. This is that we confuse what is written in strategic and policy documents with what actually happens in institutions (Ahmed, 2012). Since strategic and policy documents often serve as the public face of the university, an inordinate amount of time can go into getting them just right. This can mean that writing documents and having good policies becomes a substitute for action: as an interviewee in one study puts it, “you end up doing the document rather than doing the doing” (Ahmed, 2007).

Conscious of the dangers of reliance on official documents, one of us conducted an ethnographic investigation of one university in the decade following the publication of the Macpherson report (Pilkington, 2011). The other of us has subsequently extended the investigation to 2013 (Crofts, 2013). The university is a new university in Central England and will be identified as Midshire University.

What is immediately apparent is that at different times more or less attention has been placed on race equality. At certain points, the university made a serious effort to address the issue of race equality. At other times, the issue was not on the institution’s radar. The nadir was reached in 2003 when an audit revealed that the requirement under the Race Relations (Amendment) Act to develop by May 2002 a race equality policy and action plan had not been appropriately met. The university was subsequently required to resubmit its policy and action plan to the funding council within a limited time period. This provided an opportunity for race equality champions within the university to develop a robust policy and action plan and persuade senior management to put in place appropriate resources to support the policy and plan. It is noteworthy that what prompted the recovery was not the race relations legislation per se but the independent audit which indicated the university was non-compliant.

Race equality subsequently had a higher priority within the university. New governance arrangements and the arrival of two equality and diversity officers in 2004 subsequently gave equality and diversity generally and race in particular a higher profile. And there is no doubt that for some years significant progress was made. The conditions facilitating this

included (for a period) external pressure on the university, support from some key senior staff and the presence of highly effective equality and diversity officers.

3 The declining focus on race equality

The middle of the first decade of the new millennium represented the university's high point in terms of addressing race equality. Since then external pressure from the government has ineluctably declined. Although lip service continues to be paid in government pronouncements and some strategies to race equality and ethnic diversity, other government agendas prompted by concerns over increasing net migration, disorder and terrorism subsequently marginalised one concerned with race equality. This is evident in relation to the way new legislation introduced by the Labour government in 2010 has been subsequently implemented.

The Equality Act 2010 extended the general duties (now labelled the public sector equality duty), initially identified in the race relations legislation, to different strands of equality, with the Equality and Human Rights Commission (EHRC), a body that had been set up earlier to replace a series of bodies focused on distinct strands of equality, being charged with having an enforcement role. Over time, however, and especially since the Coalition government (2010) and subsequent Conservative government (2015) took power, the requirements embodied in the legislation have been eroded. Thus the specific duties, enshrined in statutory codes of practice, including the requirement to have in place an equality action plan and conduct equality impact assessments have been replaced by the need, on which there is merely guidance, to publish limited data and set one or more objectives. And at the same time, the red tape challenge and the significant cut in funding for the EHRC signal that racial equality is sliding down the government's agenda.

While it would be an exaggeration to say that equality and diversity, and concomitantly race equality and ethnic diversity, have completely disappeared as policy objectives, the contrast between the policy initiatives at the beginning of the century which demanded the production of action plans and the most recent government initiative which merely 'nudge[s] universities into making the right choices and reaching out in the right ways' (Cameron, 2016: 2-3) are palpable.

The consequence of the declining salience of race equality in government pronouncements and the decreasing pressure on universities to promote race equality has been felt graphically at Midshire University. At the university, this initially entailed increasing resistance to an equality and diversity agenda, but eventually led to the disappearance of any dedicated committees or equality and diversity officers (Crofts, 2013). This development was justified in terms of mainstreaming but has in fact entailed a reversal of the progress made in the preceding years to meet the general and specific duties of the race relations legislation.

What is remarkable is that at the same time, evidence of racial disadvantage remains stubbornly persistent. In our studies, we found the following: persistent ethnic differentials in the student experience that adversely impact on BME students and point to possible indirect discrimination; ethnic differentials in staff recruitment that adversely impact on Black and Asian applicants and point to possible indirect discrimination; (some) minority ethnic staff subject to racism and (some) White staff cynical about political correctness; an overwhelmingly White senior staff team, with no evident efforts to transform this situation; low priority given to the implementation of a race equality action plan; few staff skilled in intercultural issues; many staff not trained in equality and diversity; and few efforts made to consult Black and Asian communities (Pilkington, 2011).

We cannot of course generalise from this case study to the sector as a whole. Nonetheless, what we have found at Midshire University resonates with findings elsewhere (Bhopal, 2015) and points to ‘the sheer weight of Whiteness’ (Pilkington, 2014). It is impossible to comprehend the persistence of racial disadvantage and the failure to combat this without recognising ‘how deeply rooted Whiteness is throughout the ... system’ (Gillborn 2008: 9. For White staff (including White researchers) , however ‘... the Whiteness of the institution [frequently] goes unnoticed and is rationalised into a day-to-day perception of normality’ (Law, Phillips, and Turney 2004, 97). It is crucial therefore that we are reflexive and do not let ‘the “whiteness” of the academy ... go unnoticed and uncommented’ (Clegg, Parr, and Wan, 2003, 164; Frankenberg, 2004).

4 Continuing racial disadvantage in the HE sector: BME staff and students

Research continues to demonstrate that individuals from minority ethnic communities disproportionately experience adverse outcomes (Grove, 2015). While there is some variability by ethnic group since BMEs are by no means a homogeneous category, BME staff and students experience considerable disadvantage. BME academic staff are more likely to be on fixed term contracts, continue to experience significant disadvantage in career progression, especially in gaining access to the senior ranks of university management, and there remains an ethnic pay gap virtually 2 decades after the publication of the Macpherson report (Leathwood et al, 2009; ECU, 2011; Ratcliffe and Shaw, 2014)). Indeed a recent report based on interviews with BME staff is sceptical that much has changed in the last 20 years: the vast majority continue to experience subtle racism and feel outsiders in the White space of the Academy (Bhopal, 2015). Meanwhile BME students continue to be less likely to be enrolled at elite universities (UCAS, 2016) and awarded good honours degrees even when prior attainment and socio-economic status have been taken into account (Broeke & Nicholls, 2007; HEA, 2008), and to experience lower retention rates and progression rates from undergraduate study to both employment and postgraduate study (OFFA, 2016; HEFCE, 2016). In this context it is not altogether surprising that they express significantly less satisfaction with their university experience

(Havergal, 2016). And yet, despite this evidence of the remarkable persistence in racial disadvantage, universities are extraordinarily complacent.

5 Legislation and equality

This complacency partly stems from the dominance in the academy and much of society of a liberal perspective on equality. We can distinguish two broad perspectives on equality - liberal and radical. The first is concerned to promote fair or like treatment and to this end seeks to devise '*fair procedures*' so that everybody, regardless of race, receives the same treatment and 'justice is seen to be done' (Noon & Blyton, 1997: 177). The emphasis in this approach is upon sanctions against any form of racially discriminatory behaviour. The second 'represents a more radical approach since it suggests that policy makers should be concerned with the *outcome*, rather than the *process*, and should therefore be seeking to ensure a *fair distribution of rewards*' (Noon & Blyton, 1997: 182). To treat everybody the same is, in this view, to ignore pertinent differences between people and does little to eradicate disadvantage which stems from discrimination in the past and current institutional practices which result in indirect discrimination. To ensure fair outcomes - such as an ethnically balanced workforce - what are needed are not merely sanctions against racial discrimination but measures which entail positive discrimination i.e. preferential treatment of disadvantaged groups.

The government's major response to the Macpherson report was, as we have argued above, a legislative initiative, the Race Relations (Amendment) Act (RRAA), 2000. While this Act, like previous race relations legislation, was partly informed by the liberal perspective and thus prohibited unlawful discrimination (including positive discrimination), the Act was also informed by the radical perspective and adopted an approach that required public bodies to take the lead in eliminating racial discrimination, promoting good race relations and facilitating equal opportunities. To this end universities were required to produce race equality action plans in order to facilitate fair *outcomes*. Unfortunately, many of the key players in the university sector adopt a liberal perspective on equality and believe fair procedures are what is important (Deem et al, 2005; Crofts, 2013). They see themselves as liberal and believe existing policies ensure fairness and in the process ignore adverse outcomes and do not see combating racial/ethnic inequalities as a priority. This points in our view to the sheer weight of whiteness (if not institutional racism) which will remain intact unless significant pressure is placed on universities to change.

6 What is to be done?

This paper is written from a particular standpoint, notably a commitment to ‘building a socially just system of higher education’ (Furlong & Cartmel, 2009, 104)). Universities, from this perspective, will not be able to promote race equality and combat the adverse outcomes faced by BME staff and students unless they see it as their responsibility to take ameliorative action. No truck should be given to a deficit model which explains away the racial disadvantage faced by BME staff and students evidenced above. While there may be no easy answers, the key starting point is for universities to ask what they can do to ensure more *equitable outcomes*. Do we have forums which enable us effectively to consult with BME staff and students? What measures need to be taken to ensure diversity in leadership? Are there unconscious biases in selection and promotion boards at play which need to be dismantled? And so on.

We can distinguish two ideal typical approaches.

The first is sceptical as to whether universities will as a matter of course promote race equality and ethnic diversity. External pressure in this view is vital to facilitate change. To this end, the first approach believes that legislation and the enforcement of that legislation are crucial; sees a need for there to be a focus on race equality rather than equality in general; adopts a radical perspective on equality; identifies the need for action plans with clear targets which are regularly audited; requires publication of time series and comparative data to ensure transparency; and identifies the need for periodic inspection by an independent body.

The second approach is very different in visualising universities as having an inherent interest in promoting race equality and ethnic diversity in a highly competitive global marketplace where universities compete for students and require a diverse workforce. Legislation compelling universities to act in particular ways, according to this approach, is less effective than nudges and persuasion to remind them to utilise appropriate data to identify and dismantle barriers to equal opportunities for individuals from disadvantaged groups. Rather than imposing mandatory requirements, it is deemed preferable for universities to set their own objectives in the light of their own particular circumstances. Independent bodies ideally will identify good practice and disseminate it widely to the sector and even give awards to those universities who manifest good practice. In the process, universities will not merely comply with external demands but steadily transform themselves.

While neither of these two approaches can be found in their pure form in the real world, there is little doubt that the period we have examined has witnessed the transition from an approach close to the first ideal type to an approach close to the second. Both approaches have some merits. It is probably evident that I have greater sympathy for the first approach

and thus welcome EHRC's recent call for a comprehensive race equality strategy (EHRC, 2016). Adoption of this approach following publication of the Macpherson report did entail some progressive change in the sector and its abandonment prevented this being sustained both at the sectoral level and at Midshire University. It would be utopian to anticipate the return of this approach in the near future. And the second approach can entail progressive change in some universities, as evidenced by those who have met the requirements for a bronze award of the race equality charter (Bhopal, 2017).

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Applied learning through international collaboration: Using research on domestic violence as a learning tool

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Abstract

This article describes how applied learning may be achieved through a research project on an international scale. The research for this article was conducted by three Missouri Western State University (MWSU), U.S.A. exchange students from Spain in collaboration with the MWSU professor in charge of managing the project. This research involves an analysis of domestic violence. The main purpose of this study is to show what can be learned in the academic field through research from the perspective of advanced, undergraduate level students. This article will go over the processes the students followed to conduct good investigative work as well as the skills and abilities the researchers have mastered by working on this project. Such investigative work is comprised of three different approaches. The students were free to develop the research to explore the legal perspective, a sociological approach and the area of prevention of domestic violence. Each approach goes into the analysis of domestic violence to give a multidisciplinary understanding of this phenomenon. Finally, the paper offers examples of the results obtained from surveys conducted in Nepal by the MWSU professor and Nepal NGO, which were coded and interpreted by the three international students from Spain.

Keywords: Domestic violence; independent research; applied learning

1. Introduction.

An important aspect of a student's academic path is to experience out-of-classroom learning. This helps to establish the necessary skills to develop a future professional career. Independent research is an available option for advanced level students at MWSU. Independent research can be an incredibly challenging and rewarding learning experience for students who want to try alternative academic methods and faculty who want to introduce students to do research in their discipline. The investigation that this team took part in is focused on domestic violence, more specifically domestic violence in Nepal, where the professor in charge collaborated with a Nepal NGO to carry out a survey of Mobile Legal Clinic clients. The students working on this project had the freedom to decide how to approach it, attending to certain data already available. This approach encourages independence and teamwork on the part of a small, student research team. Information and ideas are shared via various internet tools, from email to a shared cloud host for information. In this case an education based Google Drive, which provides more security and capacity than a traditional Google Drive.

The project mainly consisted of each student conducting a literature review to determine the most recent research on the domestic violence topic. Each student then developed an article from the literature review comparing the already existing literature related to the topic, and then analyzing the different aspects of this phenomenon in both western cultures and eastern cultures. While developing this paper, the team also had to evaluate the Mobile Legal Clinic survey conducted by the principal investigators in the United States and Nepal to make conclusions about the results from these surveys.

In this article, the goal is to share this multi-country experience primarily from the perspective of foreign exchange students from Spain so that others may replicate this process in their discipline and setting. These students worked on this investigative team lead by the U.S. Professor on the original research done in Nepal while the students were studying in the U.S. However, this project was finished after the students returned to Spain. Most of the work in the U.S. also could have been done through internet collaboration. All of the processes and steps will be presented so that others can see why and how they might do their own research project. Then, a brief presentation of the data obtained during the research will be explained, followed by some graphs and conclusions about the survey in Nepal.

2. Process.

The research team consisted of three exchange students from the University of Sevilla (Spain), attending Missouri Western State University for one semester through a study abroad program. The students recognized the opportunities that studying in another country and educational system can provide and that their experiences would be beneficial for their knowledge in their academic field of Criminology.

At the beginning of the course, the students wanted to explore various course options. They were looking for more challenging opportunities. Professor Tushaus offered an opportunity to work on a research project on domestic violence, instead of sitting in on a traditional course in the classroom.

The students immersed themselves in the research, dedicated to learning more about this phenomenon of domestic violence. Some materials that were helpful for the research on this project, such as articles and previous student work, were provided by Professor Tushaus. This first step of acquiring more knowledge about the topic was essential for the students to learn about the process and substance of the research project, and the progression of the research work.

2.1 Investigation approach.

The students decided to focus on a comparative approach with regards to western and eastern societies. The reason for this was that as international students they wanted to contrast how this phenomenon develops within different cultural environments from the legal and social perspectives. The aim was to develop an overall theoretical framework to put the research into context, thus the team was able to critically analyze the information provided.

The theoretical references reviewed were to give the team a better understanding of the academic work already done on domestic violence. That way the students acquired the necessary skills to conduct research focused on domestic violence such as the analysis of the laws in force with regards to this issue; the review of the main sociological theories which are valid to explain why this phenomenon occurs and on which circumstances attending to two different models of culture; as well as certain propositions and strategies to prevent domestic violence.

2.2 Surveys from Nepal

Another important part of the project was to tabulate results from surveys taken in Nepal. It was the students' responsibility to interpret and code these surveys and incorporate the information found into a database. Having all of the research organized helped the students to compare articles and make conclusions later in the final section of the project. The

students decided to write about different aspects of domestic violence in order to explore a cross-cultural aspect of domestic violence. By doing this, each of the students was able to look for separate articles related to the various aspects of domestic violence. The three points that the students chose to focus on were sociological approaches, prevention and action plans, and legal perspectives. They compared Eastern and Western countries using each of these points. Using these three points to divide the paper enabled the students to focus more on specific information related to domestic violence and more easily compare the differences between countries.

Gathering the data was crucial at the beginning since the students had to be able to manage technological research tools, in this case Microsoft Excel. The students had to get familiar with the program to select and interpret relevant details about every subject studied so that they could draw informed conclusions about the phenomenon as it occurred in Nepal.

The final part of this project involved analyzing the results of the surveys conducted in Nepal. The students compared their research with the results of the survey and contrasted the differences.

3. Data.

3.1. Laws and measures

The Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) was pioneering in regards to the laws and measures developed towards domestic violence issues. In 1979, the United Nations General Assembly (UNGA) adopted the CEDAW, commonly referred to as the women's bill of rights. Article 18 of the Convention established that all members commit to submitting a report on any legislative, judicial, administrative, or any other measure they have taken to implement the Convention. This must be done within one year from the date of ratification or joining to the Convention. After the first 25 years of the Convention, the Committee has examined 401 reports presented by these members, accomplishing its function of vigilance established in the article (United Nations, 2007).

Laws in Eastern countries such as India or Nepal are focused on helping the victims by encouraging them to report their husbands or partners domestic violence. They also try to protect the economic independence of the victim and help them and their children survive after reporting their husbands. The economical dependence on their husbands is the main reason of these types of laws (Joshi, 2009).

On the other hand, laws regarding domestic violence in Europe or the United States work to reduce violence at home by punishing the offender. In the United States, there are laws that establish a protective order which criminalizes the offender's presence at home, controlling the relationships between the offender and the family members (Schawrz, 2011). Also, the

Council of Europe Convention on prevention and combating violence against women and domestic violence was developed in 2011, trying to encourage the Parties to implement measures to penalize domestic violence (Ratkovic, 2016).

3.2. Sociological approach.

In developing countries, the role of women in connection with domestic violence has not been investigated as fully, when compared to developed countries who have analyzed this connection more thoroughly. In fact, the results provided by the studies already conducted are quite diverse. For instance, in Bangladesh domestic violence has shown to be very dependent on the context which places women with high autonomy at a higher risk in conservative areas. Likewise, women from South India who take part in vocational and social activities present a higher likelihood of being victims of domestic violence (Lamichhane et al., 2011).

Social behavior patterns do not evolve as fast as other aspects such as industry or technology. The social role of women and their conduct within Indian society receives a direct influence from cultural customs or value systems which normally tend to enforce lower appreciation of females. This results in the failure to make effective and real the role that was given to women in the Constitution. The Constitution gives women the same rights as men and a role of equal importance and dignity (Mohapatra, 2015).

Roles and power of decision are governed by gender and age. The family structure in countries like India is to a considerable extent, influenced by patriarchal customs. Such setup encourages families to leave all the decision-making power to males (Sonawat, 2001).

Social and religious patterns in Nepal tend to enforce the submissive role of women in society and, therefore, to increase the possibility of the occurrence of violence (Lamichhane et al., 2011).

Families in Asian cultures are achieving quite positive changes regarding patriarchal structures and the perception of women (Sonawat, 2001), and the historical role of women is seen as one that must be respected. However, females are still having trouble improving the way they are perceived, as well as being able to effectively practice their rights due to gender discrimination. It is remarkable that governments can place effort and commitment in the prosecution of domestic violence crimes and their punishment, as well as their prevention by practically implementing females' rights and raising awareness among the population (Nagindrappa & Radhika, 2013).

3.3. Prevention and action plans

Considering primary, secondary and tertiary prevention, domestic violence all over the world is a social problem which governments try to deal with. Primary prevention efforts

are introducing new values in society and educating children, exploring awareness in domestic violence and the available resources for victims (Fernandez Alonso, 2003).

Secondary prevention is focused on at-risk individuals, reducing the factors that make the problem happen (Wolfe, & Jaffe, 2003). Some risk factors are the same around different places, including early marriage, low socio-economic and education levels, or emotional and economic dependence on the husband among others (Center for Disease Control and Prevention, 2016).

However, other victimization characteristics are unique depending on the country. For instance, in the United States conditions of unemployment and belief in a strict gender role are frequent in domestic violence situations, according to the Center for Disease Control and Prevention (hereafter CDC) (2016). In European countries, such as Spain, establishing risk factors is important so that violence can be detected and stopped in time. These factors can be victim's low self-esteem, imbalance of power in the relationship and previous domestic violence in the family of origin, among others (Fernandez Alonso, 2003). On the other side, in India, there are some other differences on the risk factors that affect domestic violence (Mahaprato, Gupta, & Gupta, 2012). Being between the ages of twenty-one and thirty-five, having a nonskilled job or a job that requires no higher education, or living in a low caste or low socioeconomic status all contribute to being more likely to be a victim of domestic violence.

One action plan directed toward domestic violence can be found in Europe, the Istanbul Convention. The main objectives are (Lousada Arocheda, 2014) promoting changes in behavior, eliminating stereotypes and role perceptions based on the inferiority of women, preventing any form of violence, encouraging society to contribute to the prevention of domestic violence, working to ensure that violence is not justified under any argument; and empowering women to help them gain autonomy. European countries are responsible for establishing measures to address these objectives.

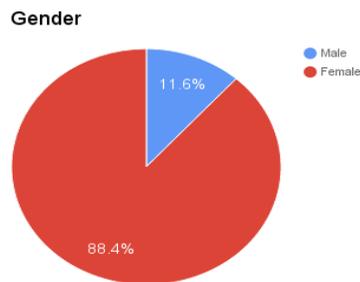
In India, the NGOs contribute by providing shelter for victims and other resources such as education and counseling. The areas of action provided by the government involve criminalizing violence, institutionalizing responses, raising public awareness, and enriching the existing database. As well as India, the government of Nepal works on a prevention plan focused on achieving public awareness of gender-based violence, punishing perpetrators according to the law, and ensuring justice to victims (Government of Nepal, 2009). This study as discussed below surveyed people in Nepal who attended mobile legal clinics designed to provide public education and assess its value to those in attendance.

4. Survey results.

The following information is concentrated on the data that has been extracted from the surveys. The format of this survey contemplates information about the type of problems experienced and what led the respondent to seek help from the Mobile Clinic in Nepal. The survey also shows the kind of help that can be obtained from the Mobile Legal Aid Clinic. The students used the surveys from the Mobile Clinics to learn more about the demographics of the respondents such as gender, age, incomes, educational level, and family size. This section proceeds to analyze and discuss the conclusions that were drawn from the surveys.

4.1. Gender

According to the data found in Nepal, the majority of the survey respondents are women, being 88.4% of the subjects, compared to 11.6% who are men. This coincides with the investigations and research previously collected, since the literature found was primarily focused on violence against women.

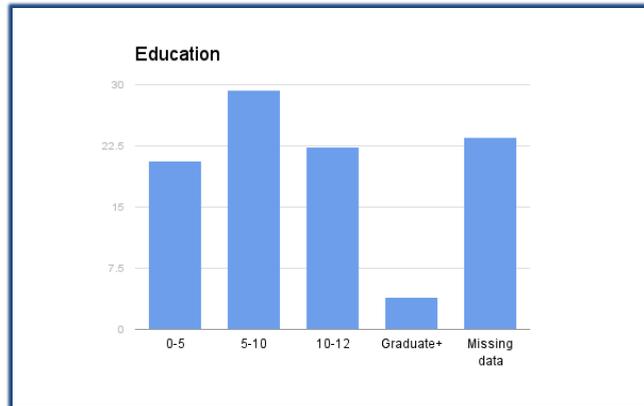


4.2. Income and education

According to the surveys collected in Nepal, the majority of the people receiving help from the Mobile Clinic had a monthly income lower than 20,000 Nepal Rupies. People with an income between Rs 20,000 and 10,001 consist of 37.9% of the subjects. Having an income between Rs 20,000 and 10,001 can be considered to be in a high economic status in Nepal. At the time this article was written 10,000 Nepal Rupees was worth less than \$92.

This may seem contradictory to what the research team has confirmed in the data since a notorious characteristic among the risk factors for domestic violence is low socio-economic status (CDC, 2016).

The income may be related to the educational level of the respondent. Only 4% of the total respondents had a graduate level education. The rest of the subjects did not graduate, being the most common respondents with 5th to 10th-grade level education. The results in this section are also in accordance with the data. Lower education is also a risk factor for domestic violence (CDC 2016).



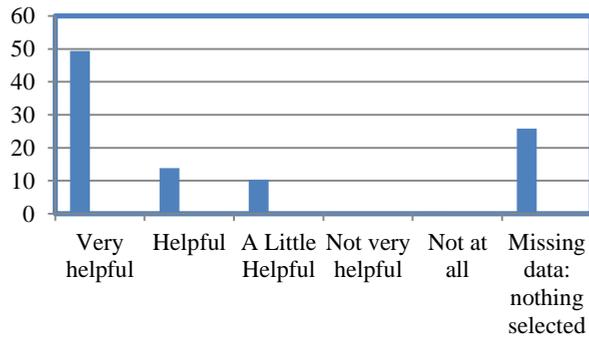
4.3. Help received

According to the statistics, the highest area of help received by victims of domestic violence is counseling with 78.9% of respondents participating. However, following the literature analyzed during the research, the resources provided to the victims by the laws in this country are focused on helping them in other aspects. The intent of this is to encourage the victims to report their partners and to be able to survive on their own, ensuring that their husbands (typically) do not leave them without any resources (Joshi, 2009).

Help Received	
Legal Problem	36.7%
Written information about the problem	24.4%
Counsel on Problem	78.9%
Other	1.1%
Missing data	5.7%

4.4. Helpfulness of clinic

This section seeks to determine if the information provided by the Mobile Clinic to the respondents was useful to them. An evaluation of the intervention shows a total of 63.2% found the Mobile Clinic helpful or very helpful. Most of these found it very helpful at 49.4%. However, 10% of the respondents thought that it was just a little helpful while 0.6% answered not helpful at all. Unfortunately, 25.8% of the subjects did not answer this question.



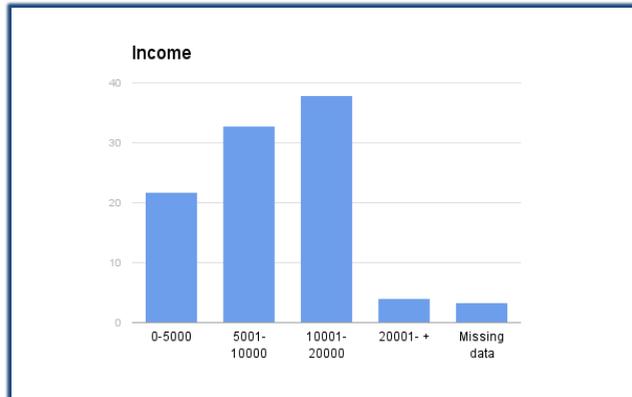
5. Conclusions: educational achievements.

An applied learning, international research project like this is replicable across disciplines and international boundaries, even at the undergraduate level. At its best, such a project accomplishes three main goals of faculty professional development. First and foremost, it is a scholarly activity. Faculty and the students who participate can contribute to the scholarly work in the research discipline.

Second, this is a teaching activity. The process serves as a teaching tool for conveying substantive and procedural knowledge. The upper level undergraduate student is exposed to the research process, the substantive area of the discipline being researched, how to communicate across international boundaries for the purpose of research and writing. This knowledge and the skills to apply it are transferable to subsequent research endeavors as well as in various business and other professional settings.

Third, a project like this can be a service activity if it is an applied learning project that provides a service to the community. In this case, the project initially helped to obtain funding for domestic violence Mobile Legal Aid Clinics in Nepal before this part of the

research project began. This phase of the project helped to establish the benefits of the mobile clinics to the Nepal participants.



From the students' perspective, the project enabled the team to develop multiple skills that helped the students to conduct complex research and analysis on social phenomena such as domestic violence. Working on an investigation like this is an opportunity to put into practice the theoretical knowledge acquired while working towards a degree in Criminology.

Some of the benefits of taking part in independent research are developing teamwork abilities in a professional environment, understanding multiple objects of study from both qualitative and quantitative perspectives, and learning how to structure properly written work and references. This kind of research project gives professors an opportunity to use their research agenda to educate their students as noted above. Students learn first hand about the research process and a substantive area of the discipline. They also learn other important skills, from team building to international collaboration using internet communication and work strategies.

In terms of this substantive topic, the phenomenon of domestic violence has shown some patterns that differ and others that relate throughout several countries in the world. During this project, the researchers have explored this area of investigation from several perspectives. This way, the students can increase their writing, investigative and organizational capacities, as well as their creativity and, in this case, English skills. All this can be accomplished while making a substantive contribution to a specific topic in a discipline.

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AIM-Mobile Learning Platform 3.0: Design of new functionalities to integrate smartphones in the teaching-learning process

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Abstract

The combination of Learning Management Systems (LMS) with smartphones is gaining importance in Higher Education studies. Therefore, we have designed a responsive virtual environment, AIM-Mobile Learning Platform, focus on integrating smartphones in class. It permits teachers to send real time questions and learning packets with multimedia resources to students through their smartphones. As the environment instantaneously processes every student response their continuous progress is automated. Moreover, the environment permits to manage teachers, subjects and students by means of a generic interface that can be applied in many educational disciplines. The new version includes more functionalities to promote their consolidation in Education. It integrates an installation and configuration package to provide high flexibility for Institutions as they can install it in their own servers. Besides, we have complemented the existing quantitative evaluation system with a qualitative functionality based on positives and negatives taking into account the participation of students in class. Finally, the new version allows students to design questions with the aim to build knowledge. These strategies seek to increase the motivation, implication and attention of students in subjects, promoting a constant feedback inside class, which helps students to be more conscious of their self-learning process.

Keywords: *Learning Management Systems (LMS); m-learning; Bring-Your-Own-Device; build knowledge; learning feedback.*

1. Introduction

The new Higher Education System requires more flexibility of the learning and teaching process, promoting the learning capacity, the motivation and autonomy of students in the acquisition of skills and the development of new methodologies to improve the continuous progress of students and to enhance the motivation of teachers. Besides, it may be very appealing to promote a natural interaction between teachers and students inside and outside classes in order to improve the quality of the teaching process. These objectives can be dealt with the integration of e-learning and m-learning (mobile-learning) strategies inside the educational scenario Jin (2009) Alli (2009). In connection with it, these new strategies encourage the use of personal devices (tablets, smartphones, laptops) in class, integrating the idea of BYOD (Bring-Your-Own-Device), that is becoming quite popular in many educational systems. In fact, students feel more confident with their personal smartphones when dealing with some learning task. On the other hand, LMS systems have increased their presence in many many educational courses. In fact, Capterra (a learning software guidance company) and the e-learning industry (the largest community of professionals involved in the eLearning industry) corroborated in the last research, Capterra (2016) e-learning Industry (2016,) that the most used LMS platforms during 2016 were Edmodo, Moodle and Blackboard Capterra (2016b). Therefore, m-learning and LMSs become a strong point in the support of BYOD inside classes Sangani (2013) Emery (2012).

In previous papers, we described the design and case of use of a novel responsive LMS called AIM-Mobile Learning Platform, a multifunctional environment that consists of a server software application (used by teachers) and a client application (used by students) Debrán et al. (2014). The environment can be directly used in multidisciplinary education contexts and it is available in English and Spanish. The first prototype was applied in Telecommunication, Education and Industrial Technology degrees with satisfactory results Debrán et al. (2016). In the preliminary versions, the environment provided functionalities to automatize a real time and continuous progress of students through smartphones, the design of electronic books with didactic resources and the management of subjects, students and teachers in an integrated way. However, the last version aims to consolidate the virtual environment as a powerful software learning tool. Indeed, the new version includes improvements and new functionalities to enhance the learning process. In summary:

- An installation and configuration package of the virtual learning environment.
- A qualitative and individual assessment functionality of students.
- A secure and robust register and access process to the student application.
- A functionality that permits students to generate knowledge and assess classmates.

2. State of the art in LMS software

LMS software is extensively used in many Higher Education courses and Institutions. For

example, Edmodo is a free learning platform that uses the social network concept permitting students join to one closed group Edmodo (2016). Teachers can share educational resources and evaluable questionnaires to assess students. However, if several teachers share a subject, they cannot visualize the educational resources or other teachers, because teachers access to their personal account. Moodle one of the most important educational platforms, is very powerful and versatile but the great number of implemented learning modules, makes the platform complex to configure and the access from smartphones becomes slow Moodle (2016). Blackboard permits teachers to carry out evaluation tasks, resources management and synchronous/asynchronous communication with students Blackboard (2016). However, both of them require a payment of licences. Other applications, such as the Classroom application, helps teachers to organize educational tasks and to share resources with students. However, since it belongs to the Google Apps tool packet for Education, it needs to download the Google Calendar, Google Doc, Gmail or Google Talk applications. On the other hand, Socrative and Kahoot!, allow teachers to send multiple choices questions to students using their smartphones Socrative Kahoot! (2016). After responses come in, teachers can show the results in class, leading to a real-time competition between students. However, they do not provide others functionalities of the learning-teaching process.

Analyzing these alternatives, none of them comply with every requirement. In fact, some of them are commercial; others need to integrate several software tools and others do not implement some educational tasks. In contrast, our proposal focus on developing a virtual environment in which teachers can easily create contents and make evaluation tasks mobile-oriented. The platform seeks to improve the real time relationship between teachers and students, helping teachers to monitor classes and students and adapt their methodologies to enhance the quality of the learning-teaching process.

3. Global design of the responsive LMS AIM-Mobile learning environment

The virtual environment consists of two applications, the server application and the client application. The server application is used by teachers and the client application is used by students (Figure 1). The server application is programmed in Java and Spring Java (2016) Spring (2016) since it has been designed for web access (more intuitive for teachers).

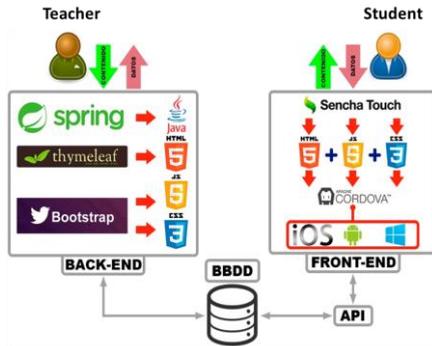


Figure 1. Global design of the virtual environment AIM-Mobile Learning Platform 3.0.

The view layer was designed with the Thymeleaf Java library Thymeleaf (2016) as it is the best suited for serving XHTML/HTML5 at the view layer of web applications. Furthermore, it was also implemented using bootstrap Bootstrap (2016) to provide Cascading Style Sheets (CSS) CSS (2016) and Javascript Javascript (2016). In contrast, the student application is available for Android, iOS and for web browsers. Therefore, it was programmed using the Apache Cordova platform Apache (2016) that permits to build native mobile applications. Together with Apache, we used Sencha Sencha (2016), since it provides HTML5-based app development tools and services for building mobile applications that run on any device. In the next sections we explain the new functionalities of the AIM-Mobile Learning Platform 3.0 and the learning objectives we want to achieve.

4. New functionalities of the teacher software application

4.1. Installation package of the virtual learning environment

One interesting functionality of the new version is the development of an easy and intuitive installation package of the platform (available in English and Spanish), so that whatever Institution can installed it without high computing skills (Figure 2). This functionality provides a powerful tool for their diffusion in different educational contexts and disciplines.

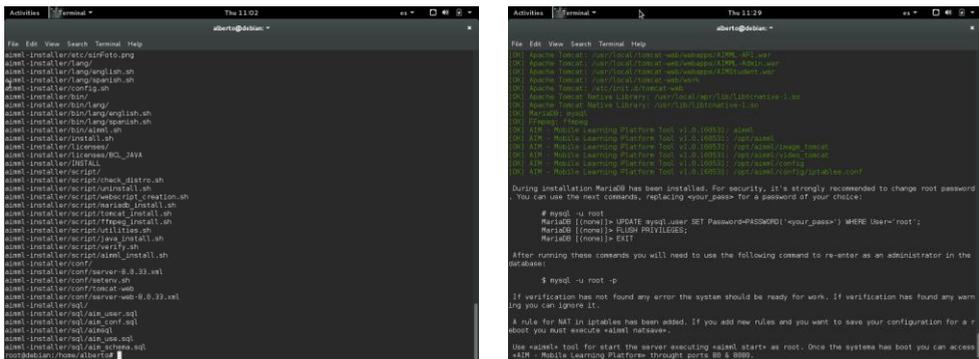


Figure 2. Intallation package of the software teacher application.

4.2. Functionality to configure the virtual learning environment

In connection with it, the new version permits to activate and deactivate functionalities inside the teacher application (Figure 3 (a) and (b)). It can be very useful for Institutions or teachers since they can adapt the virtual learning environment to their particular case of use. This new functionality only can be managed for the administrator of the platform, and it gives high versatility and flexibility for. As it can be observed in Figure3(a), the administrator activates and deactivates functionalities by pressing on buttons “Activate” “Deactivate”. Once the administrator adapts the platform, teachers only can view and consequently access to the activated functionalities of the principal menu (Figure 3(b)).

4.3. Design of a cualitative and individual assessment functionality of students

The asessment functionality of the previous versions is quantitative, massive and compulsory, as students have to answer the questions launched by teachers. However, it should be very appealing to complement it with an individual and optional qualitative assessment to check the continuous progress of students (Figure 4). Then, it was programmed a new functionality where teachers can assign positives and negatives to students, based on their participation as implication inside class. This strategy looks for encouraging the motivation and participation of students to achieve good marks. This functionality it is also available for laboratory classes where student are grouped.



Figure 3. Selection of the functionalities of the learning platform (a) Configuration (b) View of the final menu.

Assessment											
CO	CSE	DG	DISCO	GRAI	OC	SAB	SCG	SCO	SRCO	TQ	WCO
ALONSO PEREZ, ERNESTO	ANDRES GOMEZ, ANA BELEN	BLANCO VIVAR, JESUS	FERNANDEZ ROJO, SONIA	FERNANDEZ SIL, JULIAN	GOMEZ GARCIA, PEDRO						
HERRERO, MANUEL	MARQUEL LOPEZ, RAQUEL	MORA VICENTE, ENRIQUE	HUFEZ NAVOA, ANTONIO	OLANO GIL, SOLEDAD	ROMERO MIRQUEZ, MARIA						
RUBIO BLANCO, TOMAS	SANZ DE LA ROSA, DAVID	VAGUIERO JIMENEZ, OSCAR									

Figure 4. Qualitative assessment of students based on positives and negatives

5. New functionalities integrated in the student software application

5.1. Design of a flexible and secure access to the students application

This version permits to install the platform in whatever server or computer, so the student have to initialize the connection with the specific server to establish a session (Figure 5 (a)). Once the connection is verified (Figure 5 (b)), students sign in the application and they access the main menu (Figure 5 (c)). This functionality provides high flexibility to the learning environment since Universities or Institutions can install it in their own servers. Besides, this version provides more robustness and security to the overall system, since students have to register in the environment. They click on the “Sign Up” button and a new view to fill the user name and password is opened (Figure 6 (a) (b)).

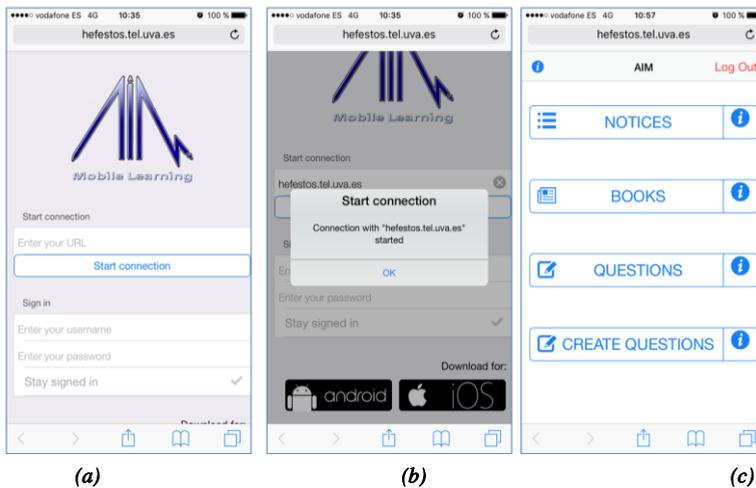


Figure 5. (a) initial view of the application (b) connection with the server (c) main menu of the application

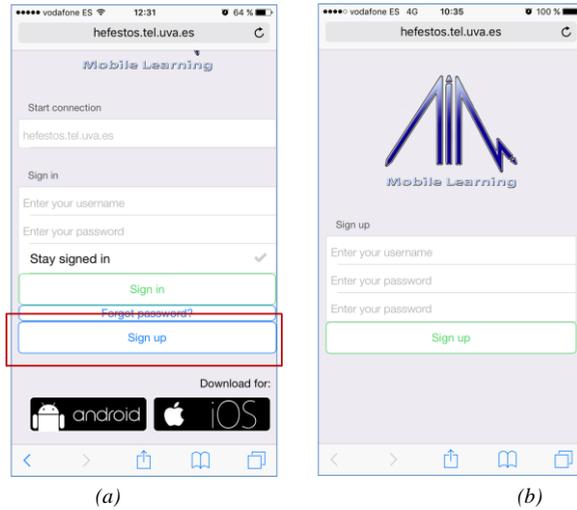


Figure 6. (a) register button (b) functionality to enroll at the learning environment

5.2. Functionality to allow students to generate knowledge

The use of the learning platform inside class has positively encouraged students to demand more implication with it, asking for designing their own questions to be launched to their classmates. This learning strategy allows students to build knowledge, promoting a very interesting collaborative process between students. As a consequence, they can check the acquired knowledge inside class and it helps to empower their autonomy, motivation and work capacity. To use this functionality, students have to press the button “Create Questions” in the main menu (Figure 7 (a)). Then, students have to fill the statement of the question (Figure 7 (b)) and the corresponding solutions (“wrong”, “correct”) (Figure 7 (c)). Finally, they choose the date and time in which the question is launched.

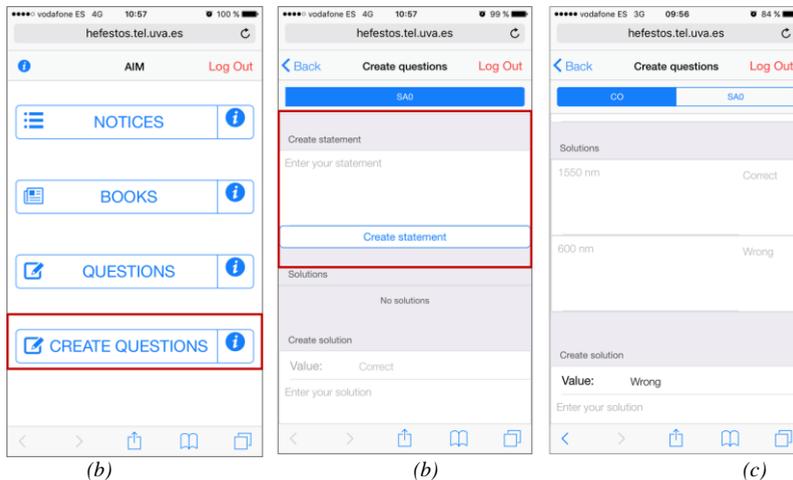


Figure 7. Functionality to design questions (a) main menu (b) fill statement (c) fill solutions.

6. Conclusions

The AIM-Mobile learning platform 3.0 has evolved their functionalities to be more powerful, versatile and flexible for their diffusion in many educational disciplines. This version provides an easy and transparent installation package so that Institutions can install it in their own servers. Besides, it incorporates a qualitative assessment of students based on positives and negatives that complements the existing quantitative and massive evaluation process. This strategy looks for increasing the motivation and participation of students inside class to enhance their continuous progress. Another interesting functionality is to permit students to design questions to be launched to their classmates. It encourages students to build knowledge and check the one acquired during classes, improving their learning abilities and increasing their motivation and self-learning autonomy.

Acknowledgment

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Assessment of microproject-based teaching/learning (MicroPBL) experience in industrial engineering degrees

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Abstract

An assessment program to evaluate microproject-based teaching/learning (MicroPBL) methodology on the technical subject Manufacturing Technology was implemented for four consecutive academic years. Students from three engineering degrees were involved providing feedback through various surveys that allowed us to perform a proper evaluation. More specifically, students' surveys were anonymous after each academic year, except the last one, which included both non-anonymous pre and post-surveys. The polls were mainly meant to evaluate the acquisition of specific competences (using technical questions about the subject) as well as generic ones (using questions concerning soft-skills). Students' satisfaction with the methodology and with the signature, in general, were also checked. Non-anonymous surveys enabled us to study the correlation between polls results and students' final scores. Note that students' self-assessment concerning their knowledge about technical aspects drastically changed after the course. The average final score of this subject from student's perception was slightly higher than the real value. Moreover, student's self-perception on soft-skills increased at the end of the course. In general, the proposed MicroPBL methodology demonstrated a beneficial impact on students of Manufacturing Technology keeping high-motivation levels in students as well as high success rates and scores.

Keywords: *PBL; microproject; assessment; engineering degrees; competences.*

1. Introduction

Over the last decades, higher education institutions has broadly applied project based learning (PBL) in order to leave aside the traditional ‘spoon-feeding’ teaching, promoting student’s active work through realistic and challenging projects (Gary, 2015). Literature reported many PBL-based activities but only few of those implemented were conducted together with proper evaluation systems. The majority used the classical ‘student satisfaction survey’ without going deeper in the different factors affecting students along the teaching activity (Grahm, 2010). This work presents an assessment methodology that evaluates PBL, specifically one typology called *microproject-based learning methodology* (MicroPBL). Authors presented the MicroPBL in previous works (Fernández-Ceniceros et al., 2015; Fernandez-Ceniceros et al., 2014) with interesting preliminary results reported (Fernández-Ceniceros et al., 2016). Briefly, MicroPBL proposes the use of small projects involving emerging manufacturing technologies on behalf of international entities acting as virtual employers. Basically, students working in teams during three weeks design, simulate and finally produce a real part that fulfills the requirements expressed by the foreign entity. Coaching, seminars given by experts, evaluation sheets are also complementary actions in the methodology. The MicroPBL was implemented in the technical signature *Manufacturing Technology* along four consecutive academic courses. Three engineering degrees at the University of La Rioja (‘Mechanical’, ‘Electrical’ and ‘Industrial Electronic and Automation’) offer this subject. During the four years, surveys provided to the students during the course together with students’ final scores represent valuable information to evaluate the suitability of the methodology proposed. Last academic course (2016-2017) a complete assessment program was introduced to increase the quantity of feedback from the students. Pre and post-surveys, following the recommendation reported by (Carmenado et al., 2012; Rodriguez et al., 2015), were conducted to evaluate the influence of the MicroPBL on specific and generic competences. Importantly, as far as the surveys remained non-anonymous, they could be correlated with the student’s final scores. This fact is a differentiation point with previous PBL assessment methodologies.

2. Methodology

Along the first three academic years, students’ global perception on the MicroPBL methodology was evaluated by anonymous surveys based on a scale ranged from 1 to 4 (1 represents ‘totally disagree’ and 4 ‘totally agree’). The surveys included questions about: (i) the use of English language to define aims and tasks of the microproject and the communication with the petitioners, (ii) student’s interest on MicroPBL methodology compared to traditional teaching, (iii) relevance of manufacturing tangible products and (iv) seminars given by experts or visits to local factories.

The modified evaluation of the MicroPBL methodology for the last academic course included a complete set of surveys. Additionally to the previous evaluation, the new surveys included non-anonymous, but confidential, pre and post-surveys at the beginning and at the end of the course. The pre-survey follows the methodology proposed by (Rodríguez et al., 2015) containing questions regarding: (i) self-assessment on previous knowledge on the subject (technical questions on specific competences), (ii) self-assessment on soft-skills (questions on generic competences) and (iii) opinion and experiences regarding PBL and active learning in general. The post-survey included the previous three questions plus: (iv) evaluation of the MicroPBL methodology and (v) perception about the subject in general. The post-survey was conducted before students' grades were public.

3. Results and Discussion

3.1. Anonymous surveys results at the end of each academic year

The evolution of the results obtained from the anonymous surveys at the end of each course corresponds to the Figure 1. Authors evaluated the MicroPBL with the average scores obtained in four key areas over four consecutive academic years: 2013-2014 (104 students), 2014-2015 (82 students), 2015-2016 (72 students) and 2016-2017 (67 students). The lack of two of the four bars for the course 2013-2014 was due to the fact that the manufacturing of a tangible product and the seminars/visits were improvements implemented during the academic year 2014-2015.

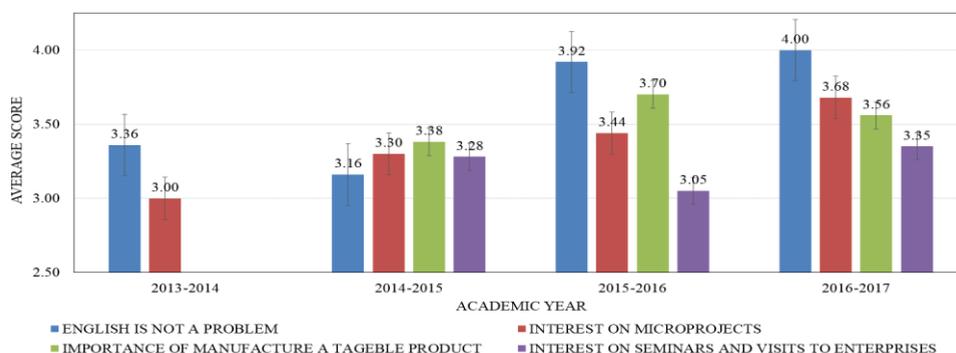


Figure 1. Results of the anonymous surveys at the end of each course to evaluate the MicroPBL methodology.

The results indicate a positive evolution in the perception of the students concerning the use of English. Students feel that English does not represent a problem anymore for them. Note that the interest on microprojects has also risen steady every year, probably due to the improvements incorporated every year into the MicroPBL methodology with more practical and ‘hands-on’ elements to generate a tangible product at the end of the microprojects.

The success rates of students before and after the MicroPBL methodology (Figure 2) increased and remained stable during four academic years. The average final score showed the same behavior with a continuous increase every year with the new MicroPBL.

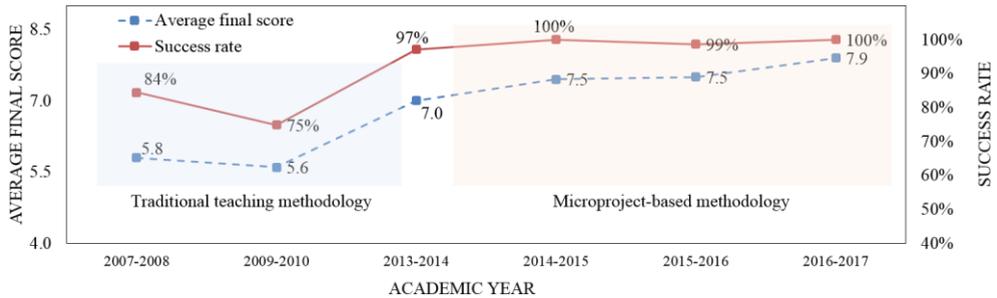


Figure 2. Average final score and success rate in the subject for academic years from 2007 to 2017

3.2. Non-anonymous surveys results from the last academic year (2016-2017)

A total number of 67 students were enrolled in the subject (59 male and 8 female). The surveys included 27 valid responses (paired samples). The MicroPBL methodology was applied to all the students along with other active learning methodologies, most of them based on cooperative learning.

Table 1 details average and standard error scores of students’ answers to the technical questions (specific competences). Paired *t*-test was used to compare pre and post-survey results providing significant differences. Students’ perception concerning their knowledge about technical aspects of the subject drastically changed after the course. Students seem to feel more confident in welding and 3D printing areas. Generally speaking, students’ perception changed positively showing that they gained knowledge in technical aspect with the teaching activities and demonstrating the efficacy of MicroPBL methodology. These results are in concordance with other studies on PBL-based methods (Andersson et al., 2000; Estevez-Ayres et al., 2015; Rodriguez et al., 2015).

Table 1. Survey questions and pre and post-average scores regarding the subject specific competences (technical questions) (p-value < 0.05).

Question	Pre-Survey Average	Post-Survey Average	t-test p-value	Statistically significant $\alpha=0.05$
Q1. I know/understand the basic principles of the machining process.	1.88±0.20	3.73±0.09	1.69E-08	YES
Q2. I know/understand the advantages/disadvantages of the machining process and when is suited to use it.	1.73±0.16	3.58±0.10	5.79E-11	YES
Q3. I know/understand the basic principles of the plastic injection molding.	1.56±0.16	3.42±0.11	3.29E-11	YES
Q4. I know/understand the advantages/disadvantages of the plastic injection moulding and when is suited to use it.	1.46±0.14	3.27±0.13	8.59E-13	YES
Q5. I know/understand the basic principles of the welding process	2.15±0.18	3.85±0.07	6.62E-08	YES
Q6. I know/understand the advantages/disadvantages of different welding process	1.78±0.19	3.54±0.14	6.81E-10	YES
Q7. I know/understand the basic principles of the metal forming process.	1.42±0.13	3.35±0.14	2.28E-13	YES
Q8. I know/understand the advantages/disadvantages of the cold and hot metal forming processes.	1.46±0.16	3.54±0.10	2.55E-12	YES
Q9. I am able to design/calculate an open-die forging/cold rolling/ blanking/deep-deep-drawing process.	1.23±0.10	3.58±0.14	7.71E-16	YES
Q10. I know/understand the basic principles of the 3D printing process.	1.76±0.18	3.85±0.07	4.73E-10	YES
Q11. I know/understand the advantages/disadvantages of the 3D printing process.	1.92±0.18	3.80±0.08	3.69E-09	YES

The non-anonymous surveys enabled us to compare students' perception about their knowledge and achievements after the subject. The average of final score from student's perception (8.2 ± 0.2) was slightly higher than the average of actual final score (7.9 ± 0.3) per student (Figure 3). A contrast *t*-test demonstrated that there was a statistically significant difference between those values. An explanation for this perception is that our methodology transmits significant feedback to the student or student's perception was overoptimistic.

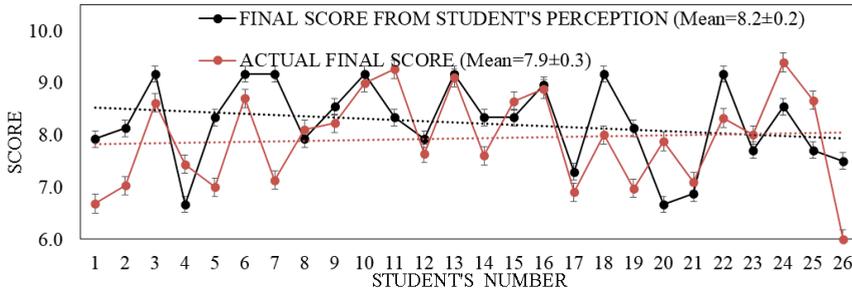


Figure 3. Comparison regarding students' final score on the subject: student's perception and actual final score.

Self-assessment results regarding generic competences (soft-skills) were divided into seven questions and represented in Table 2. Similarly to the previous survey detailed in Table 1, the score significantly increased ($p<0.05$) after the subject in all the questions formulated.

Table 2. Survey questions and pre and post-average scores regarding the subject generic competences questions (soft-skill questions).

Question	Pre-Survey Average	Post-Survey Average	t-test <i>p</i> -value	Statistically significant $\alpha=0.05$
Q1. I have great oral comm. skills	2.92±0.09	3.16±0.12	1.31E-07	YES
Q2. I have excellent team working skills	3.31±0.09	3.54±0.14	2.55E-03	YES
Q3. I have strong team leadership skills	2.92±0.10	3.35±0.14	3.40E-06	YES
Q4. I solve problems creatively	3.08±0.09	3.32±0.11	1.71E-05	YES
Q5. I can get what really matters from texts and everyday situations	3.15±0.14	3.42±0.13	1.25E-03	YES
Q6. I manage my time efficiently	2.62±0.16	3.00±0.16	2.64E-07	YES
Q7. I am a proactive person that propose and implement solutions	2.96±0.12	3.38±0.14	5.31E-07	YES

The scores observed in the generic competences show that students felt more confident on their soft-skills after the course. This effect might be considered as an enhancement of their self-confidence on soft-skills thanks to the PBL-based methodology proposed, somehow also observed by other authors (Frank et al., 2003; Rodríguez et al., 2015). Team leadership, time management and proactivity resulted in the highest differences, being time management a target skill for improving in the following experiences.

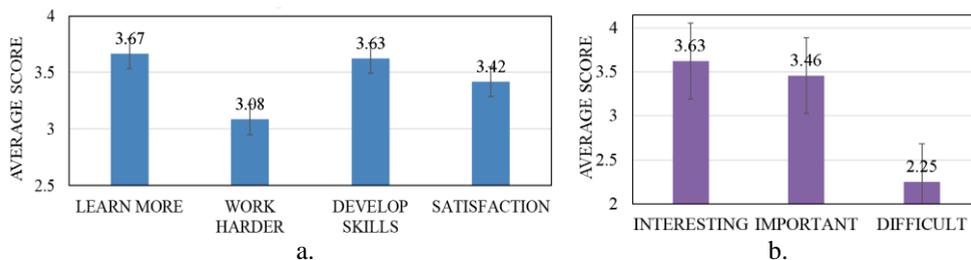


Figure 4. a) Students' average scores regarding the MicroPBL methodology questions. b) Average scores of post-survey questions regarding the signature in general.

Students considered that MicroPBL methodology allowed them to learn more, develop more soft-skills and with more satisfactory results than with the traditional learning methods (Figure 4.a). They also think that they do not work harder or the subject is less difficult to them (Figure 4.b), contrary to other PBL experiences, where students usually answered the opposite (Rodríguez et al., 2015). This is probably due to the lower complexity of the tasks proposed in this generalist and introductory subject, but this may change along advanced subjects related to their degree.

4. Conclusions

An assessment program to evaluate MicroPBL methodology on the technical subject 'Manufacturing Technology' was implemented for four academic years. Surveys were anonymous every year except the last one, in which non-anonymous pre and post-surveys to evaluate the acquisition of specific and generic competences were conducted. These allowed us to correlate students' perceptions and final scores. Students' self-assessment concerning their knowledge about technical aspects drastically changed after the course. The average of the subject's final score from student's perception was slightly higher than the actual value. Moreover, student's self-perception on soft-skills increased after the course. Both appreciations are in agreement with other reported experiences. Summarizing, the MicroPBL methodology demonstrated beneficial for the technical subject maintaining high-motivation students, which was directly related to students' success rates and final scores.

Acknowledgements

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Sciences come alive for first-year university students through flipped classroom

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Abstract

This paper discusses an initiative implemented for on-campus first-year nursing and midwifery students studying Human Body, a course which covers core Anatomy and Physiology, at a South Australian university. The initiative implemented was flipping the classroom with the objective of facilitating active learning. Formal lectures were replaced by student-centred activities that encouraged studying the topics before coming to class, discussing their understanding and misconceptions, and determining the new learning that was achieved during class.

A post-flip classroom survey was used to gauge the impact of the initiative on students. Of the 532 students enrolled, 188 students completed the questionnaire for a 35% response rate. The survey queried students' views about the flipped classroom, their experiences with the teaching format, the learning that transpired, engagement with content and study materials, what they liked about it, impact on their test scores, and areas to improve the initiative. Findings showed 60% preferred the flipped classroom approach. Students were actively engaged with and challenged by the content. They actively participated and learned, and found the flipped classroom to be interactive, enjoyable and fun. In fact, 77% of respondents recommended flipped classroom to future students.

Keywords: *University teaching formats; Flipped classroom; Active and collaborative learning; Technology advancement.*

1. Introduction

One of the recent developments in higher education is the flipped classroom, which pertains to learning that occurs outside the classroom and subsequently discussed inside the classroom (Baker 2012; Barrett 2012). In flipping the classroom, educational institutions are able to provide a high quality, flexible, and interactive platform for students (Educause Learning Initiative 2012) where cognitive skills and abilities such as reflecting, analysing, and evaluating are strengthened (See & Conry 2014).

The motivations for adopting the flipped classroom in higher education are many, including: diversity in students' demographic characteristics; need to be flexible to address diversity; reduced contact time with students; propagation of superior materials; technological advancements; and access to a wide range of resources. There is also the need to teach students to be active, independent and self-directed in their learning, whilst at the same time, providing meaningful engagement and support for their learning. Flipping the class was viewed as one way to address these needs.

Flipped classroom as a teaching and learning initiative was trialled by science academics for a group of first-year on-campus students undertaking a Human Body course in a metropolitan university campus in South Australia. The initiative was conducted by replacing traditional lectures with flipped lectures that were aided by providing out-of-classroom content and activities, thus allowing more classroom time for active learning and peer collaboration (See & Conry 2014). The purpose of this paper is to discuss on-campus students' perceptions about flipping the classroom for some aspects of the Human Body course.

2. Flipping The Classroom

The course that was flipped was Human Body 1 with a unit value of 4.5, where one unit is calculated to be about 35 hours of work. Initially, the teaching arrangement for this course involved weekly three-hour lectures and two-hour tutorials/practicals per study period. Human Body 1 was common to the Nursing and Midwifery curricula and offered on- and off-campus. Nine topics on the body systems were covered. Four topics were flipped, while the rest were taught via traditional lectures.

In flipped classroom, lectures (averaging 1.5 hours/week) were pre-recorded and made accessible to students at the beginning of the course, before the face to face flipped lectures. The concept-based recordings were deliberately shortened and streamlined. Also, students were provided with readings and additional resources, such as relevant YouTube videos and online materials, for further engagement and understanding. These clips were short (15 to 35 minutes maximum).

Physiological concepts were the focus of the pre-lecture recordings. To check comprehension, self-assessment quizzes in multiple-choice question format were made available. Students were requested to undertake these quizzes before attending the flipped lectures. The lecturer would monitor the number of students who took the quiz, check their performance, and gauge which conceptual questions were easy or difficult for students. This way, the lecturer was able to emphasise, explain, and elaborate on areas students found challenging and needing support during the face to face flipped lecture.

3. Research Design

In order to evaluate the outcome/s of flipping a class, survey methodology was used at the conclusion of the study period. Questionnaires were administered to students online via the Survey Monkey to obtain information concerning their perceptions, experiences, and satisfaction or dissatisfaction of the flipped classroom. A pre-flip survey was also conducted at the beginning of the course to obtain pertinent student data.

This study was conducted at one of the three universities in Adelaide, South Australia.

An introductory letter was emailed to all on-campus nursing and midwifery students enrolled in the course informing them about the initiative. The lecturer invited students via email to participate in the surveys.

The impact of the flipped classroom was assessed using an instrument consisting of thirteen (13) statements on a Likert scale and two (2) open-ended questions. Specifically, the questionnaire examined students' views their experience with the teaching format, the learning that occurred, engagement with content and study materials, what they liked about it, impact on their test scores, and areas to improve the initiative.

The approval of the University's Ethics Committee was sought and obtained for this study. Voluntary participation and confidentiality were ensured. Descriptive statistics and thematic analysis were used to analyse the data.

4. Findings

Of the 532 internal students, 246 completed the pre-flip survey, representing a 46% response rate. Table 1 summarises the pre-flip survey that queried students' demographic details, science background, and awareness and experience of flipped classroom.

Table 1: Pre-flip survey results

Question items	Percentage (%)
Little to reasonable science background	43
Unaware of what flipped classroom is	74
Had not experienced flipped classroom in the past	95
Looking forward to flipped classroom	45
English is first language	80
Domestic student	94
School leaver	59
First in the family to attend university	49
Did not identify as having an Aboriginal or Torres Strait Islander background	97

Of the 532 students enrolled, 188 accomplished the post-flip survey, representing a 35% return rate. The table below indicates students' perceptions and experiences of the flipped classroom that were conducted.

Table 2: Post-flip survey results

Question items	Percentage (%)
Course content was easier to understand through the flipped classroom style	61
Rated the initiative positively (good 27% / very good 32%/excellent 26%)	86
Three most popular reasons chosen for liking flipped teaching:	
View lecture recordings and other resources before the lecture	60
Apply and check their understanding	57
Clarify some concepts	60
Students listened to pre-recorded lectures	76
Attempted quizzes to test knowledge and understanding	51
Prepared before traditional lectures	53
Preferred flipped lectures to traditional lectures	60
How flipped classroom could be improved:	
More time to prepare	61
Flipped style used for all lectures	24
No improvements necessary	33

There were several reasons for this positive appraisal gleaned from the open-ended responses, and these have been categorised into five themes. The themes, supported by the appropriate quotations describing them from the participants, are as follows:

Theme 1: Flipped classroom focused on students' learning needs

"With the lecture time, I was able to follow up to clarify any difficult concepts which was useful for my learning."

"We spend our time at home learning the content, then we can come into the class and have that knowledge tested. It is also a better way to spend contact time with staff as we are given the opportunity to ask questions face to face."

Theme 2: Flipped classroom involved students' active participation

"I get to prepare before attending the lecture, I have an idea of what I'm going to be learning about, and identify areas I need to revise on further."

"... the fact that its broken down to more than one lecture is good, so I can watch the second and third another time. I am engaged in my learning."

Theme 3: Flipped classroom enhanced self-efficacy

"I think it really motivated my learning and made it easier to reflect on the information I was learning."

"It gave me tools to help myself learn the human body."

Theme 4: Flipped classroom encouraged higher order of thinking

"Allows opportunity for discussion and analysis ... reinforcing what we have learnt."

"Introducing case scenarios in the flipped lecture enables us to see the relevance of science concepts for nursing practice. How science is relevant to nursing ..."

Theme 5: Flipped classroom made science fun

"I liked that they were interactive and we were given questions to reassure our learning and understanding."

“It is fun and it provides an opportunity for students to check their understanding.”

5. Discussion and Conclusions

Contemporary nurses and midwives need to be equipped with knowledge, skills and confidence in order for them to keep up with the fast pace of information and technology advancements. They need to be taught to think critically, assess, evaluate, update their knowledge, value evidence, develop problem-solving skills, and deliver appropriate, holistic, and patient-centred nursing/midwifery care. The reliance on traditional teaching methods such as lectures may be limiting students in addressing their educational needs.

This study demonstrated that implementing a flipped classroom was one strategy to meet the educational needs of future nurses and midwives. Findings revealed that there were positive outcomes for flipping a class. Five (5) themes emerged characterising the flipped classroom implemented for the students and these contributed to the learning that transpired impacting on the quality of students' learning experience. It was shown to be a promising instructional strategy, encouraging students to engage with the course content and with peers and lecturers, thus facilitating a high level of engagement and interaction. The initiative achieved time and space for student-student and student-academic to connect and interact more about a particular topic. Comments such as *“They are engaging.”* *“They're interesting.”* *“Interactive learning is far more beneficial”* were positive and encouraging for staff. Other authors corroborated these findings (Demetry 2010; Kim, Kim & Khera 2013; See & Conry 2014). These positive results resonated with the work the same authors undertook examining the perceptions of off-campus students on flipped classroom (Thalluri & Penman 2016).

However, it is important to be cautious in interpreting the results because of the modest post-flip survey response rate of 35%. More respondents will yield stronger reliable conclusions. Future directions for action include providing adequate orientation and clear objectives and expectations, continuous development of this initiative, and regular evaluations to ensure that maximum learning is achieved and course objectives are met.

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Enhancing business students' skills through a cross-curricular activity

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Abstract

This paper describes the experience of a cross-curricular activity that combines mathematical knowledge with several soft skills, namely the use of new technologies, teamwork and critical thinking. Two different subjects are involved, Mathematics 2 and Information Systems, both part of the Bachelor's Degree in Business and Administration, taught at Universitat Internacional de Catalunya. 42 students participated in this pilot activity during the second semester of the academic year 2015/2016.

Results indicate that students considered the activity useful and that it helped improve their knowledge on information systems and the fundamental concepts covered in Mathematics. Data gathered also reveal that students positively valued the idea of applying concepts of one subject into other subjects. As for the development of soft skills, students converge in that the activity helped them developing interpersonal skills and being more critical with one's work.

Keywords: *cross-curricular activities; hard skills; new technologies; peer-assessment; teamwork.*

1. Introduction

Higher education institutions (HEIs) are increasingly required to infuse an interdisciplinary approach among the courses and subjects taught. This call emerges from the need of boosting cooperation, learning, and research between the different disciplinary frontiers that have traditionally fragmented the university. In response to this demand, HEIs are immersed in a re-definitional process, adapting their programs in order to trigger integration and interdisciplinarity. Some examples include the creation of large-scale research projects, undergraduate training courses, and innovative graduate curricula (Holley, 2009).

It is widely acknowledged that universities should not only concentrate in fostering hard skills (i.e., knowledge regarding the discipline or profession), but also allow students develop a lifelong learning attitude with the acquisition of soft skills, which are transferrable to other fields (Badcock, Pattison, & Harris, 2010; Kember, 2009). The ability to cooperate, communicate or solve problems exemplify these competences. Active learning methodologies are particularly appropriate for infusing such skills. They consist of involving students in the learning process making them participate in activities that improve their performance during and after the course (Bell & Kozlowski, 2008; Prince, 2004).

In this context, the present study reports the experience of a cross-curricular activity designed to enhance students' hard and soft skills. Students are required to apply their mathematical knowledge (hard skills) in an IT subject, where they learn advanced features of the Excel work package. While performing this activity students develop several soft skills: teamwork, use of new technologies, and critical thinking (this latter through peer assessment). The underlying rationale behind this activity lies in bringing together two different subjects taught in the first course of the Bachelor's Degree Program in Business Administration at the Universitat Internacional de Catalunya (Barcelona, Spain).

2. Description of the activity

2.1. Sample

The sample comprises 42 students from the 45 enrolled in the subject Information Systems. The activity was compulsory and was developed during the second semester of the academic year 2015/2016, after completing Module 1 in the course on Mathematics 2. Initially, students were divided in 15 teams of 3 students, but only 14 teams presented the task. In order to promote cooperation and ensure a shared level of mathematical and technological knowledge between the different teams, students were grouped according to their average grades (continuous evaluation and exams) in Information Systems and Mathematics 1 and 2.

2.2. Description

The activity was developed using an online platform (Moodle) as a support. This way, the instructions, team members, delivery of the tasks, peer assessments, and final grades were posted on the Moodle of the Information Systems course. Each team had a different exercise to solve (different statement based on the same concepts).

The activity had two parts (see Figure 1 and 2), and consisted on using Excel for:

1. Representing a 3D graph of a function of two variables.
2. Representing a 2D graph of the given function. The graph shows the level curve of the function that corresponds to a value of z specified in a cell of the Excel sheet.

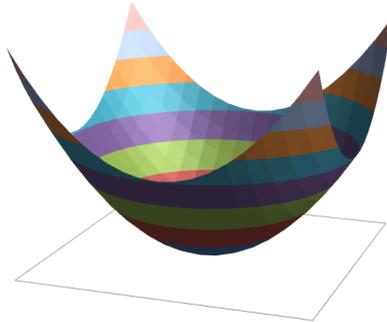


Figure 1. 3D graph of a function of two variables in Excel.

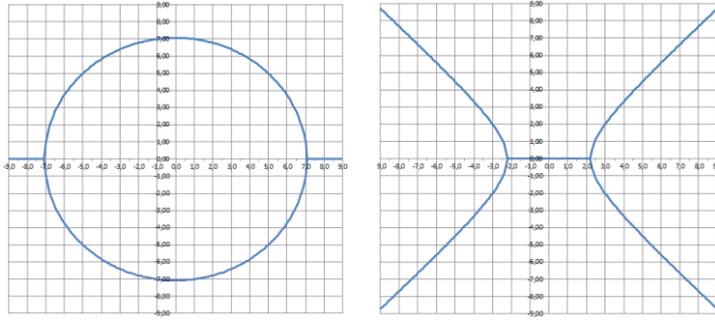


Figure 2. 2D graphs of a function of two variables in Excel (level curves for different values of z).

2.3. Assessment

The activity had a 15% weight in the Information Systems final grade. The exercise was both evaluated by the instructor and by other students (peer assessment). Each team was thus required to evaluate two different teams. Specifically, the final grade in the activity was composed by three grades:

1. Grade given by the lecturer.
2. Grades given by the other two teams.
3. The accuracy with which the team evaluates the two teams assigned. This grade was calculated based on the difference between the grade given by the lecturer and the grade assigned to the other teams.

Both the lecturer's evaluation and the peer assessment were based on the rubric shown in Table 1. The activity statement and the rubric were given at the beginning of the activity so that students exactly knew how they were going to be evaluated before starting.

Table 1. Rubric for the evaluation of the activity.

Concept	Weight
3D function	40%
Data table	20%
Rightness of the calculation	10%
Choice of the data range and the interval	10%
3D graph	20%
Clarity in the representation	15%
Choice of the point of view	5%
Level curves	60%
Cell to choose the value of z	15%
Clarity and visibility	5%
Error message if the choice of z is outside the range	10%
Data table	25%
Choice of the number of series required	5%
Choice of the data range and the interval	10%
Error management and data outside the domain	10%
Graph of the level curves	20%
Clarity in the representation	10%
Redrawn without losing proportions	10%
TOTAL	100%

The acquisition of both soft and hard skills pursued with the activity was measured using a specific questionnaire.

The students' acquisition of mathematical knowledge was tested by a series of questionnaires. After finishing Module 1, students were asked to resolve a test in an individual fashion about the concepts that they will later apply in the activity. The instructor collects and corrects all the tests but no feedback was provided. Next, students completed the activity. After, they answered again the same test, but this time they received feedback (from both tests). Because students were given the opportunity to go beyond the theoretical concepts by performing the activity in the Information Systems class, the grades obtained in the second test were expected to be higher.

3. Results

Figure 3 graphically illustrates the grades from the lecturer (in blue) and from other teams (in red and in green). From this figure, it can be inferred that except for groups E, K, L and N, evaluations were quite homogeneous. Particularly, the graph suggests that in the aforementioned cases students tended to be more critical with others' work than the lecturer was. Note that teams H and K were only evaluated by one group as the team responsible for evaluating them (team O) did not deliver their activity.

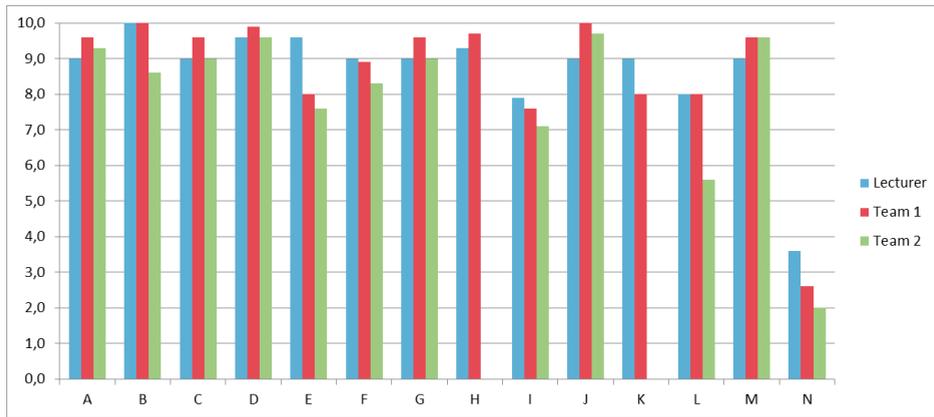


Figure 3. Lecturer's evaluation and peer assessments.

Aiming to examine whether all team members really took action in the activity, students had to answer an anonymous questionnaire indicating in a scale from 1 to 5 their own level of involvement as well as that of the students working in their team. Table 2 displays the main results. Given that the average evaluations were fairly high, it can be concluded that all team members were on an equal footing with one another.

Table 2. Team member involvement in the activity in Information Systems (scale from 1 to 5)

Team	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Average evaluation	3.83	3.75	3.67	2.75	3.50	4.25	5.00	2.75	3.83	4.17	4.00	4.83	4.00	2.50
Standard deviation	1.60	1.90	1.75	0.82	1.51	0.84	0.00	1.97	1.83	1.17	1.17	0.41	1.22	1.29

As a way to compare the usefulness of the activity, when students had completed Module 2 they had to answer a test (similar structure as in Module 1 but covering the content of Module 2). A couple of weeks later, they were asked to repeat the same test of Module 2. Little variation of grades was expected between these two latter tests as no cross-curricular activity was implemented for this module. Results in Table 3 confirmed our initial intuition.

Table 3. Grades associated to tests in Mathematics 2

	Before	After	Improvement
With activity	4.84	5.38	11.16%
Without activity	4.29	4.29	0.00%

Finally, Figure 4 shows students’ opinions regarding the learning strategy, the methodology used, and the acquisition of soft and hard skills as a consequence of this activity.

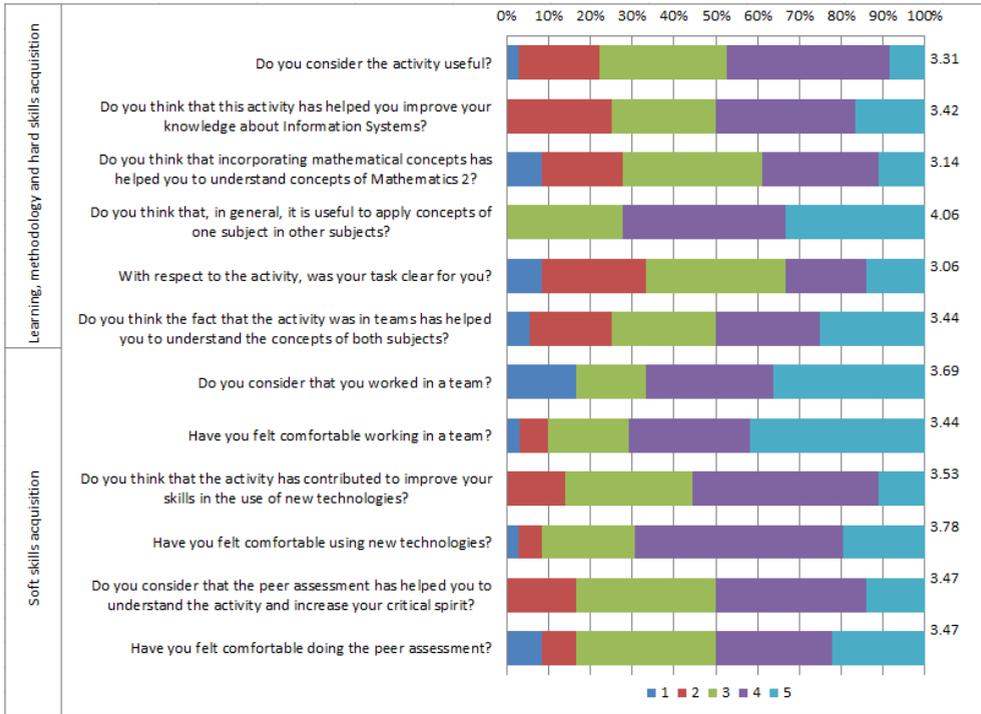


Figure 4. Results obtained from students’ feedback in Information Systems (numbers in the right hand of the figure indicate the average grade in a scale from 1 to 5).

The item that was most highly ranked (4.06 out of 5) was the usefulness of applying concepts of one subject to another one, reinforcing the adequacy of cross-curricular activities as the one presented here. It also remarkable that, for this item, all evaluations reached a minimum score of 3. This result further corroborates the suitability of adopting such an approach. Regarding the development of soft skills, both teamwork and the use of new technologies were highly valued (3.69 and 3.78, respectively). On the contrary, students considered that the activity could be improved in terms of the clarity of the task to be done (3.06). Undoubtedly, this feedback will be very helpful for future editions in improving the way instructions are communicated to students.

4. Discussion and conclusion

Cross-curricular approaches to teaching and learning have been recently disrupted the educational landscape. This pedagogy is characterized by a synthesis of, knowledge, skills and understanding from various subject areas. Although academic literature addressing this topic is still scarce, this pedagogy is increasingly being discussed and utilized by educators.

The purpose of this paper has been to provide evidence of the usefulness of cross-curricular activities in the higher education context. More specifically, the activity described is intended to connect and combine two different subjects. That is, new learning from Mathematics and Information Systems is put together to generate a valued experience. The rationale that underpins this pedagogy spans out from the work of individual instructors to collaborative approaches.

As for the case described, the intertwining of the two disciplines selected is shown to deepen the response to a single experience. Our findings reveal that thanks to the cross-curricular activity, students' performance (in terms of the mathematical knowledge gained) substantially improved. In addition, while conducting the activity students strengthened technological skills, improved their interpersonal skills (teamwork) and learned how to critically assess others' work.

Team working is considered one of the essential skills that should be provided by universities (Ruizacárate Varela, García-García, González-García, & Casado-Sánchez, 2013). When learning with others, students are able to learn more because of the process of achieving a shared understanding during the development of the activity (Cortez, Nussbaum, Woywood, & Aravena, 2009). Thus, teamwork becomes a positive learning experience while it inspires genuine cooperation among students. Furthermore, our activity is complemented with a peer assessment task. As a learning instrument, assessing others boosts critical thinking and helps students learning what a high-quality work consists in (Liu & Carless, 2006; van Zundert, Sluijsmans, & van Merriënboer, 2010).

We hope this experience encourages other instructors to design and implement cross-curricular initiatives. Although an effective implementation of such initiatives requires an extra effort compared to the use of traditional lectures and a clear definition of the objectives to be achieved in each of the disciplines involved, we believe it promotes authenticity in teaching and learning.

This study is not free of limitations and from the feedback obtained, there is still room for improvement. Specifically, some issues that need to be fixed which constitute opportunities for future editions might include: clarifying the tasks to be done and the expected outcomes, involving more instructors in the design of the activity, adding more cross-curricular

activities for the other modules of the course on Mathematics 2, allowing students a blank space for additional feedback.

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Personal development, resilience theory and transition to university for 1st year students

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Abstract

The study aimed to determine whether an outdoor orientation programme (OOP) could increase personal development, develop resilience and aid transition and adaptation in 1st year university students. OOPs are thought to aid transition through adventure experience. Based on student development theory, outdoor orientation programmes accelerate psychological growth (Vlamiš et al., 2011). Semi structured interviews were conducted with 14 students who attended an outdoor orientation programme to investigate the experience of attending an OOP and transition to university. The data was analysed following Braun and Clarke (2006) Six phase approach to thematic analysis. Thematic areas discovered included 'Personal development – Building more than a raft'. This theme described the way in which students developed self-worth and self-efficacy through the OOP experience. 'The fine line between challenge and fear' describes how delivery of an intervention such as an OOP needs to be carefully delivered to enhance the benefits and limit any possible detrimental experiences. These first year students developed in terms of self-worth and self-efficacy through overcoming challenge. This development was also linked to the students surprising themselves about their capacities for handling adversity.

Keywords: *Adaptation; transition; 1st year students; outdoor orientation program; resilience; personal development.*

1. Introduction

Poor adaptation and transition to university can lead to poor student experience and ultimately dropout. Universities are judged on their ability to retain students and student satisfaction. Transition and adaptation for 1st year students is a difficult issue to unravel due to the multitude of variables that can influence this experience. Interventions which enhance psychological resilience may help students through this potentially challenging time.

Transition and adaptation to university for first year students involves change to an individual's sense of self at a time when the role of identity and interaction are particularly important. A lack of confidence, personal difficulties can lead to poor adaptation to university (Leary & DeRosier, 2012). The emotional, social and academic adjustments that accompany this transition can cause individuals to question their self-worth (Carr, Colthurst, Coyle & Elliott, 2013).

Strategies which could help the transition and adaptation for 1st year students are important to universities, where 'success', linked to student satisfaction, is now assessed through the National Student Survey (NSS). The results of the NSS can have a lasting significant impact on student recruitment students, which brings important financial and reputational implications for the university.

One potential approach to helping students transition and adapt to university is to provide Outdoor Orientation Programmes (OOP). Usually OOP is delivered in small groups of 15 or less and involve camping or staying over for at least one night (Bell, Holmes, & Williams 2010). Based on student development theory, these programmes aim to accelerate psychological growth (Vlamiš et al., 2011); this psychological growth is thought to aid transition to university.

Incoming 1st year university students face an array of potential challenges and problematic scenarios causing academic and interpersonal stress. For example, many students who move away from home may have lost social support networks at a time when pressure to succeed in a new environment is intensified (Conley, Travers & Bryant (2013). In this period well developed individual coping resources will support success (Davidson, Feldman & Margalit, 2012).

Outdoor orientation programmes are thought enhance coping resources by building resilience (Ewert & Yoshino, 2011). Resilience can be understood as 'the capacity for maintenance, recovery or improvement in mental health following life challenges' (Ryff, Singer, Dienberg Love & Essex, 1998). Therefore, to build resilience OOP needs to offer challenges; physical and emotional. With many interconnected dimensions affecting restoration, resilience can also be enhanced by supplementing the direct OOP experience

with social support, self-confidence, mastery, competence and coping strategies (Allen, McKenna & Hind, 2012).

Therefore the use of OOP has potential as a retention intervention for universities. Qualitative research is required to explore whether - and how, if appropriate - personal challenge can build resilience in 1st year students and how this can influence adaptation and transition to university.

1.1 Research question

To determine whether OOP can increase personal development, develop resilience and aid transition and adaptation in 1st year university for students.

2. Method

2.1 Context for the current research

The OOP was selected by the University as a strategy to aid student adaptation, three student degree programmes were included on the OOP. The OOP was a three-day residential experience based in rural England. It was scheduled to run in the first week of teaching of the 1st year students first term. It was fully funded by the University. The OOP was being used directly to maximise its impact in a critical period of the student's higher education experience.

The accommodation was a large hostel. Students took part in five activities including team building, gorge scrambling and raft building with evenings nominated as free time; the hostel had a bar, a games room and other social spaces. Students were allocated roommates and activity groups.

2.2 Research strategy and participants

Semi structured interviews were conducted with 14 students who attended the outdoor orientation programme to investigate the experience of attending an OOP and transition to university. The semi structured interview is the appropriate method of eliciting experience (Langdridge, 2007; Smith et al., 2009). Interviews were conducted within a month of the OOP and analysed following Braun and Clarke (2006) Six phase approach to thematic analysis.

Thematic analysis is a method of data analysis, rather than being an approach to conducting qualitative research. This is a strength because it ensures the accessibility and flexibility of the approach. The themes are identified at a semantic explicit level rather than a latent level due to the requirements of the research project and the direct nature of the questions.

Full ethical approval was granted for the research project via the institutions research ethics panel.

3. Analysis

3.1 Personal development – Building more than a raft

Some students entered the OOP experience with low levels of self-efficacy and self-confidence this can manifest as feelings of stress and being scared. The nature of such adventure experience dictates that for some it will pose higher levels of challenge. This element of challenge could be perceived as a negative by individuals at the time, yet is one of the OOP's main strengths. It gives individuals opportunity to overcome resistance and therefore aids in personal growth and increases resilience.

I was scared because I'm not an outdoors person, I've never really liked outdoors, never liked heights, I can't really swim that well so when it said about swimming I was like oh my god I don't know what to do, erm I was really stressed about it, my parents were like oh it'll be fine and you'll enjoy it. I was like no I would literally rather do anything else than go on this residential so I was panicking quite a lot about it (Alison).

This is in stark contrast to other students with a distinct amount of self-confidence. The quote below demonstrates this confidence but it also shows a high level of familiarity with this type of scenario, this in itself would reduce feelings of apprehension and unease. Some individuals already possess a level of self-efficacy which allows the approach of experiences like OOP to almost seem incidental.

It was in the lake district so I go there every year anyway to do like a walking holiday type of thing so I kind of knew the place and the surrounding area and I was looking forward to it because I like that sort of stuff, I like just getting involved, I'd rather do that than be in a classroom all the time or something like that so I found it really good, when I got the letter I was like yeah I'm up for it so yeah it was good (Jack).

3.2 Building Self efficacy and self confidence

A key element of outdoor orientation programs is to be both physically and emotionally challenging. By overcoming these challenges students improve self-confidence, mastery and competence and strengthen coping strategies and therefore as a result resilience.

I was on gorge scrambling and I was scared, I didn't want to do it at all because I don't climb and I didn't want to fall and get hurt so I didn't really want to do that at first but as we did it I started to like it and I can climb apparently so yeah it was good after (Carrie).

I was hoping to surprise myself more than anything because I was stressed that much about it I was hoping I might surprise myself and do more than I think I can do. I sat under a waterfall for 5 seconds so I think I definitely surprised myself (Alison).

It was better than I thought it could be, a lot better. It's made me more confident in my own ability to do things and not to doubt myself as much (Alison).

These improvements to self-esteem, concept and efficacy as demonstrated above are attributed to the success of OOP's influence on adaptation to university. The OOP is aiding student's personal growth by providing a platform of carefully selected activities in the correct environment. This is a clear example of the strengths of OOP having a clear influence on the participating students.

3.3 Building self-confidence and self-efficacy through shared experience

The activities on OOP programmes look to develop social skills such as leadership and self-esteem. The quote below demonstrates a clear message of developing self-efficacy through overcoming challenges as well as the additional benefit of increasing social confidence through the opportunity to meet peers.

Yeah they were a great experience socially and other things like being able to get over things that you weren't so sure about at the start. I feel like it gave you the confidence to be able to accomplish more if you get what I mean. Yeah I'd say it enhanced my confidence socially

*and with the work as well and that's the sort of thing we need to learn
as well for PE the OAA stuff (Claire).*

Self-efficacy is demonstrated clearly in the quote below with students acknowledging their strengths and weaknesses and allocating tasks based on these attributes.

I just think we divided roles, we all knew what we were doing. We identified strengths and weaknesses before we started so like some people knew what they were doing with knots and some knew how they were going to organise the raft so we divided up roles and did it that way (Michael).

While others who were self-confident in certain tasks and activities actively looked out for other team members and guide them through difficult situations. This can provide increased self-confidence for the person helping whilst also providing the person that required help a level of support to achieve group goals.

They were pretty easy. I found it really easy, it was nice to be able to help people who haven't done it before, do you know jack the little Indian lad, we went on the first day where there was really rough water and he kept getting dragged away so I obviously knew how to do it so I helped telling people to 'Go there then go there, and cross here' which worked even better because I was team leader, it was all right (Toby).

3.4 Challenge building resilience

Overcoming difficult challenges may build resilience. The quote below shows a slightly more apprehensive narrative, yet this is underlined by a clear level of determination that could be termed resilience.

I might panic a bit during the residential but I'll kick myself if I don't go because I've got to look at it on the aspect that its uni, it's an experience that because I want to be a teacher is going to be something that is part of the curriculum that I will have to teach OAA at some point (Alison).

Some students harboured negative feelings towards the residential trip. The process of transition is not always one which is smooth yet these feelings of resistance once overcome may help enhance the individual's resilience therefore adding to the effectiveness of the OOP before it as even begun.

Erm I don't like that kind of stuff in all honesty. Mainly because when I was back in high school that was the last time I did it and even back then I was dreading it, I guess nothing really changed so when I initially got the letter I thought why are we doing this and what's the point erm I guess I overlooked the fact of getting to know people and meeting people and stuff like that. It was one of those things that I thought I'd got out of. So that's how I thought when I initially received it (Steve).

3.5 The fine line between challenge and fear

The below quote that highlights sometimes challenges can be too tough for some people. Yet failure can play a key role in teaching that sometimes sustained effort is required and also how to turn failure into success, the key is to have the difficulty at an achievable level not a debilitating level.

I cried all the way through the cave, I didn't know we were going in it until we got outside it, they also didn't tell us that we would be climbing, and you fell over didn't you (Toby).

Whereas for others they embraced the challenge even when it came to a situation when someone who could not swim engaged in a water based activity. This is an example of a well-constructed activity that has involved water but not required swimming ability, it is therefore an inclusive activity that has allowed certain individuals to embrace fears and achieve. Overcoming such challenges aids in personal growth through self-efficacy and self-worth.

I had to jump in with John and he couldn't swim, he just clung on to me and I was like 'get off', we had life jackets on so it's not like we were going to die. There was a few people who weren't confident doing stuff but as soon as they did they were, like, I don't know why I was worried (Michael).

4. Discussion

The research projected aimed to determine whether OOP can increase personal development, develop resilience and aid transition and adaptation in 1st year university students. Initial feelings of apprehension were described by students regarding the OOP experience. These feelings mirror the feelings of many incoming 1st year university students (Leary & DeRosier, 2012). Overcoming this apprehension and challenges to self-confidence and self-worth are therefore important in this transitional period.

The theme ‘personal development, building more than a raft’ highlights in vivid detail how the OOP process provides personal physical challenges. The activities were challenging and in some instances described as worrying. This level of challenge is widely advocated e.g. (Ewert & Yoshino, 2011) to encourage feelings of achievement and success. A number of the students provided example of how they ‘surprised themselves’ with what they achieved. This indicates the activities provided a challenge appropriate experience. These findings align with previous research findings (Allen, McKenna & Hind, 2012)

Therefore it could be said that personal growth was achieved through the platform provided by the OOP to challenge themselves and succeed. By overcoming the challenges the achievement can provide development of self-efficacy and self-worth. Self-worth and self-efficacy are thought to be important factors in developing resilience (Grant & Kinman, 2012). The OOP could enhance resilience in 1st year university students. This is especially important given that research into student adjustment found one of the main problems facing transitioning students is challenges to their self-worth (Carr, Colthurst, Coyle & Elliott, 2013). This resilience could be essential in overcoming such challenges.

One aspect of challenge which was an unexpected research finding was ‘social challenge’. The students spoke of the pressures of developing friendships, this provided a challenge to self-confidence. The activities were set up in such a way to require team building, trust and communication with others. Such an environment and activities aid social group development. Student relationships were solidified through other activities and enhanced by sharing living space and free time periods. The environment the students have been placed in encourages certain behaviours based on the shared goals and common interests therefore completing common challenges in a physical sense facilitates interactions, as does the common goal of making friends. Peer support, support from activity staff and university staff helped in both social and personal terms.

Not all findings were entirely positive. The theme ‘The fine line between challenge and fear’ highlighted that for some people challenge can go too far and in some instances be debilitating. Some students required assistance from other students to complete the activities. The value in being helped depends on how this is understood by the recipient. Therefore requiring assistance may challenge self-efficacy and self-worth when a positive

outcome cannot be achieved. Similarly this may enhance self-worth and self-confidence through being valued, understood and aided by their peers. The students who provided assistance to their peers could further enhance their self-confidence and self-worth through this altruistic behaviour.

One potential limitation is the application of the research findings explored in the thematic areas. The participant sample was from a small university in the north of England. This limitation could be countered by research evidence from universities across the world which evidences similar stress and challenges facing students (Conley, Travers & Bryant, 2013; Thomas, 2012). Therefore the themes such as 'Building self-confidence and self-efficacy through shared experience' and 'Challenge building resilience' may resonate with many 1st year students.

The research findings could have potential implications for incoming 1st year students. Intervention activities that enhance student resilience can provide students with the personal 'tools' to succeed in this difficult transitional period. The OOP experience has provided this enhancement in the participants interviewed for this study.

In conclusion the OOP has seemingly enhanced self-efficacy and self-worth for this group of 1st year students. This was achieved through providing a platform which encourages personal growth through overcoming challenges such as the physical and social challenges of OOP. Improving self-worth and self-efficacy through a retention intervention such as OOP can potentially build resilience. This resilience could be useful for 1st year students in this potentially difficult transitional period.

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Reasons for the poor employability of the first degree in students' perceptions

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Abstract

The reduction of the first degree in Portugal, driven by the Bologna reforms, has resulted in a perceived loss of its value in the society and the labour market. The implementation of the reforms coincided with the severe economic crisis and the job scarcity currently affecting the labour market. This paper aims to investigate student perceptions of the reasons why they consider the first degree insufficient. Is it because students really feel unprepared for the labour market as a result of the shorter first degree or is it because of the widespread perception in the society that the first degree is insufficient? In other words, is the poor employability of the first degree perceived as being determined by individual inability or by an external scepticism about its value? Findings suggest that, for students, the first degree is not enough mostly because of their individual inability to respond to labour market needs and less because of public scepticism about the degree's worth. Therefore, students apparently see themselves as the key agents, emphasising their own responsibility for employability and the individual factors behind the employability concept, although the latter are somewhat balanced by external factors under the weight of the economic crisis.

Keywords: *First degree; Employability; Higher education; Student perceptions; Bologna process; Portugal*

1. Introduction

Further to the Bologna process and the reorganization of the degree architecture, the value of the shortened first degree for the labour market was debated in various European countries (Schomburg and Teichler 2011). Fears of poor employability of the degree have been mostly confirmed in Southern European countries. On the contrary, in countries with more solid economies, like Germany or Austria (Schomburg and Teichler 2011), the fears about the acceptance of the new bachelor degrees on the labour market proved to be unjustified, as most bachelor graduates were neither unemployed, not in poor/precarious employment. However, in Portugal, a country which has been facing serious economic constraints and job scarcity, previous studies (Cardoso et al. 2012; Sin et al. 2016a, 2016b; Vieira and Marques 2014) have shown that the first degree has lost credibility for the labour market, after it was shortened from 4/6 years to 3/4 years.

Considering these two different contexts, how do students, in a country where the first degree has depreciated, interpret this lost of value? Is it because students feel they are effectively unprepared for the labour market or is it because they internalise the widespread perception in the society that the first degree is insufficient? In other words, the paper explores whether the poor employability of the first degree is perceived as being determined by individual inability or as being determined by an external scepticism about its value.

2. Individual versus external factors for employability

There are two main dimensions to keep in mind in the interpretation of employability. A first one is the absolute dimension (Brown et al. 2003) which comprises individual abilities, attributes and pro-active dispositions (Fugate et al. 2004; Van der Hejde and Van der Hejden 2006). For example, Fugate et al. (2004, 15) define employability as 'a psycho-social construct that embodies individual characteristics that foster adaptive cognition, behaviour and affect, and enhance the individual-work interface'. Such conceptualisations fail to acknowledge contextual determinants which may be equally responsible for an individual's professional success. Thus, external factors, beyond an individual's control, that determine employability must also be acknowledged. These make up the relative dimension (Brown et al. 2003), which is related to external factors such as the macroeconomic situation and the state of the labour market (MacQuaid and Lindsay 2005), individuals' relative position compared to other job-seekers (Brown et al. 2003), or employer preferences and discrimination (Cai 2013). For higher education graduates, employability is further conditioned by institutional brand and reputation and field of study (Rothwell et al. 2008; Jackson 2014). In the current Portuguese context and the reform of the degree structure, the perceived devaluation of the first degree (Cardoso et al. 2012; Sin

et al. 2016a) can be seen as another external factor that determines the employability of first degree holders.

The two dimensions of employability have not been equally acknowledged in recent labour market and employment policies. In particular, the relative, external dimension has been played down. Dominant political discourses have been focusing on the individual dimension, promoting individual responsibility for employability, marking a policy shift away from a focus on fostering employment (a state obligation) towards fostering employability (an individual obligation) (Bridgstock 2009; Brown et al. 2003; McQuaid and Lindsay 2005). Policy-makers see employability as the possession of attributes (Holmes 2013), holding individuals responsible for their professional success/failure. This tendency was critically designated as the 'politics of blame' (Thrupp 1998), whereby failure is attributed to individuals rather than to the policies themselves. These conceptual tools, which reflect the complexity of the employability construct, will be used as the theoretical lens to explore students' opinions as to the poor employability of the first degree.

3. Methodology

Data were collected in 2015 through focus groups interviews. Around 70 students in the last year of the first degree from a selection of disciplinary areas – Arts/Design, Computer Engineering and Management – participated in the focus groups (5 to 6 in each group). The disciplines were chosen in order to capture the disciplinary variation regarding the hard/soft and pure/applied dimensions (Becher and Trowler 2001) and to give insight into potentially contrasting differences by discipline. Additionally, and also to explore possible differences, the selected students belonged to the four institution types present in Portuguese higher education: public/private and university/polytechnic (see Table 1). Universities are research-oriented, while polytechnics have a vocational mission and are responsive to local economic needs. Discussions were held separately, in each discipline and in each institution.

Table 1. Institutions and study programmes which participated in the focus groups

Institution	Type	Study programmes
Institution A	Public University	Arts Computer Engineering Management Visual Arts and Arts Technology
Institution B	Public Polytechnic	Computer Engineering Tourism Management/Business Studies Design
Institution C	Private University	Computer Engineering Management (or Hospitality Management)
Institution D	Private Polytechnic	Computer Engineering Management
Institution E	Private Polytechnic	Arts (Illustration/Graphics/Multimedia)

The discussions explored the participants' understanding of the meaning of employability, their perceptions about the employability of the first degree and who they held responsible for employability. Discussions were transcribed and analysed with the help of the qualitative analysis software MaxQDA, following a grounded theory method (Strauss and Corbin 1990). In the case of students' understanding of employability, two major categories emerged: one which framed employability around external factors and another which focused on individual factors. In the case of the employability of the first degree and its value for the labour market, the following categories stood out: essential, sufficient, insufficient, career development. Regarding the attribution of responsibility for employability, the categories were: students, higher education institutions, employers and policy-makers.

4. Findings: Reasons for the (in)sufficiency of the first degree

The majority of opinions pointed to the insufficiency of the first degree for the labour market, with only few perceptions that the first degree was sufficient for employment. As previous research (Sin et al. 2016a; Cardoso et al. 2012) has already suggested, students appear to regard the master degree as the new positional good to get competitive advantage or to avoid unemployment. Nevertheless, a minority of students who had already been employed for several years, all of them studying in private institutions, attached value to the first degree as a means of career progression or development.

When explaining why they believed the first degree was not enough, students invoked feelings of unpreparedness to start working, which were frequently related to a perception of compression of the study cycle further to the Bologna reforms. As a result, they thought they did not have time enough to acquire the knowledge and competencies they would need on the labour market. However, the perception of insufficiency was also based on the fact that, according to students, the society itself believed the degree was not enough, although this was less frequent (and mainly encountered among students in public institutions) than the feeling of unpreparedness. Therefore, the perception they themselves were lacking knowledge and competences necessary in a future job was stronger than the perception that the society did not value the first degree, which suggests that, in students' views, the first degree is not enough more because of individual inability than because of public skepticism. This assumption is strengthened by the way in which students understand both the responsibility for employability and the concept of employability itself, dimensions in which their role as active agents stands out.

That students attributed the poor employability of the first degree primarily to their own unpreparedness for the labour market also suggests that they feel they are the ones responsible for being employable (see also Sin et al. 2016b). In fact, when asked to whom they attributed the main responsibility for employability, the overwhelming opinion was that students themselves were the main responsible, and in a lesser degree higher education institutions and employers. However, this overall finding hides some interesting variations. It is noteworthy that students in polytechnic institutes regarded this responsibility as rather balanced between three actors: themselves, higher education institutions and employers. Since polytechnics are vocational institutions meant to respond to the economic needs of their region, students have higher expectations from their institution and from employers to develop a closer relationship which would result in employment.

Table 2. Counts for codes related to employability

Dimensions	Codes	Counts
First degree	Easier to achieve	2
	Career progression/development	8
	Compression	20
	Lack of maturity	4
	Sufficient for employment	12
	Insufficient	39
	Essential for employment	8
Responsibility for employability	Policy-makers	3
	Employers	13
	Higher education institutions	15
	Students	20
Employability concept	External factors	63
	Employer preferences	24
	Employment characteristics	20
	Macro-economic situation	9
	Labour market	10
	Individual factors	62
	Differentiation from others	4
	Personal competences	26
	Field related skills and knowledge	7
	Job seeking skills	2
Practical/work experience	13	
Soft skills	10	

Regarding disciplinary differences, Arts students held employers as the main responsible for their employability, while Engineering students saw themselves as the main responsible agents. This may be linked to the labour market opportunities available to these two student groups. While the labour market destinations are opaque and blurred for Arts students, the disciplinary area of Computer Engineering students has a relatively clear correspondence with a labour market niche. Therefore, it appears plausible that Arts students should hold employers responsible, while Computer Engineering students place the onus on themselves.

This assumption could be further corroborated by the way in which students interpret employability. According to the literature, employability is understood as a multi-faceted concept which comprises both individual and external factors, determining the likelihood of being successful in the job market (Brown et al. 2003; McQuaid and Lindsay 2005). Given students' feeling of unpreparedness and self-responsibility for employability, one could expect individual factors to weigh more heavily than external factors. However, students, in equal measure, referred to these two dimensions to describe their understanding of employability. On the one hand, students understood employability to be related to their possession of certain individual characteristics, such as: competences like versatility, proactivity and entrepreneurship, soft skills, field-related technical skills and knowledge, and the ability to stand out among other students. On the other hand, students are facing adverse circumstances, that is a precarious labour market further to a difficult macro-economic situation in southern European countries (Scarpetta et al. 2010; Cairns et al. 2014; Cutuli and Guetto 2012). This may explain the balance between external and internal factors found in this study. Should the external circumstances be less hostile, the weight of individual factors would probably be more evident. Among the external factors considered to be influencing employability, the following stood out: employer preferences (in terms of the higher education institution and discipline); employment characteristics related to students' expectations of a certain quality of employment (match with the study area, stability, income, and career progression); labour market; and macro-economic situation.

A difference emerged between the perceptions of students in public and private institutions. The former, in a larger degree, stressed the individual factors as determinant for their employability. Associated with the fact that these students are also the ones who have higher expectations of the quality of employment, these findings suggest that public sector students are less affected by graduate unemployment as a consequence of the economic crisis. The hierarchy in the perceived value of higher education institutions, where public ones are regarded more highly than private ones (Tavares and Cardoso 2013), is therefore likely to be replicated in students' employment opportunities.

5. Conclusion

This paper aimed to investigate student perceptions of the reasons why the first degree is insufficient for the labour market. Overall findings suggest that, according to students, the poor value of the first degree is explained by their individual inability to respond to labour market needs rather than by public scepticism about the degree's worth. In fact, students seem to consider themselves unprepared to start working, given the insufficiency of the acquired knowledge and competences in the now shorter first degree. This is a noteworthy finding about the perceived consequences of the foreshortening of the first degree as a result of the Bologna reforms. The intended paradigm shift towards student-centred learning and learning outcomes appears not to have borne fruit, judging by students' perceptions. Therefore, institutions may not have done a proper and thorough reform of the degrees to achieve Bologna's ambition that the first degree should be relevant for the labour market. This is an important finding for institutions and programme leaders who could rethink their curricula, should they see employability as part of their mission.

Although their feeling of unpreparedness to enter the job market appears to have been triggered by supposedly unsuccessfully implemented educational policies, students continue to place themselves in the driver seat when it comes to their employability. The other findings reinforce the fact that students look primarily towards themselves when making sense of employability (or lack of). Overall, they see themselves as the key agents responsible for employability and emphasise the individual factors behind the concept, although the force of the economic crisis has balanced the weight between individual and external factors. This suggests that policy-makers could also take measures to help graduates' transition to the labour market.

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Teaching agile methodologies in a project management course

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Abstract

The increasingly dynamic, competitive and volatile business environment that characterizes today's marketplace demands for rapid delivery of high-quality outcomes, aligning development with customer needs and company goals. Agile methodologies have gained widespread popularity due to their easy implementation and adaptability to different industrial contexts. Although these methodologies originally emerged in the software and computer science field, they have been rapidly imported to other disciplines such as management and business.

This paper describes an activity developed in a Project Management course during the academic year 2016/17. The activity is designed with the objective of not only teaching students agile methodologies (and scrum in particular), but also to allow them understand the basis of such methodologies by implementing a class project. The activity details as well as students' perceptions are analyzed and discussed. The feedback collected indicates that students positively valued the activity and that they believe that through this activity they have been able to learn the fundamentals of agile methodologies.

Keywords: *Agile methodologies; scrum; project management; higher education.*

1. Introduction

Building innovative business models, processes and products require a new approach to management in general, and project management in particular (Highsmith, 2009). Project management needs to move faster, become more flexible and responsive to customers. Agile methodologies aim at fulfilling this role. They reduce complexity by breaking down the long cycle of building requirements and testing. Instead, they use small, usable parcels that can be designed and tested in manageable short cycles (Cubric, 2013). The term “agile” is used as an umbrella in the fields of software development and project management, and includes methodologies such as Scrum, Feature Driven Development, Dynamic Systems Development Method, eXtreme Programming, Lean, Six Sigma, or Kanban, among others. Agile methodologies promote frequent inspection, adaptation, and a leadership philosophy that stimulates teamwork, self-organization and accountability. Change and flexibility are thus the trademarks of agile projects. Agile puts less emphasis on up-front plans and strict control and relies more on informal collaboration, coordination, and learning.

This study reports the experience of a class activity in which students learn the basics of agile methodologies. Although there is a myriad of agile methodologies that emerge as alternatives to traditional project management, we focus on scrum, perhaps one of the most widely used approaches to agile project management. For most companies, the adoption of scrum is the first step towards agility, what have caused a considerable increase in the use of such methodology during the last few years (Mahnic, 2012). Specifically the project is expected to simulate different roles, ceremonies (meetings) and sprints as a way to give students a broad overview of this methodology, its foundations, principles and advantages. The experience reported took place at the Universitat Internacional de Catalunya during the academic year 2016/17. Students participating in this project were enrolled in the Project Management course, a compulsory subject included in the Master’s Degree in Business Administration and Production Systems.

2. Theoretical underpinnings

In recent years, organizations worldwide have increasingly adopted agile development methodologies (Salo & Abrahamsson, 2008). The adoption of such methodologies has been proved to facilitate the management of the development process, to reduce overtime, and to positively impact on customers’ satisfaction (Mahnic, 2012). Agile methodologies are particularly important in the project management field, because, when applied correctly in the right setting, they result in better productivity and quality projects with lower risk. In this context, it is of utmost importance that project managers understand the applicability of agile development methodologies to their projects. Likewise, they should underline the key factors that can drive their projects to a proper consecution.

As opposed to “traditionalist” development methodologies, which are based on extensive planning and categorized processes, agile methods rely on “people and their creativity” (Dybå & Dingsøy, 2008). The foundations are in the Agile Manifesto (2001). There are four principles: (1) individuals and interactions over processes and tools, (2) working software over comprehensive documentation, (3) customer collaboration over contract negotiation, (4) responding to change over following a plan (<http://agilemanifesto.org/>). In this context, agile methods present the advantage of rapidly accommodating to today’s fast changing markets (Karlström & Runeson, 2005; Qumer & Henderson-Sellers, 2008).

Despite the growth in the application of agile methodologies in the industry, academic research on this topic is still scarce, as most of the existing publications are written by practitioners or consultants (Abrahamsson, Warsta, Siponen, & Ronkainen, 2003; Chow & Cao, 2008; Conboy, 2009). A need for more empirical studies is thus obvious. In the specific context of agile project management, learning experiences are underrepresented compared to the use of agile methodologies in software-related disciplines. Although in the recent years this trend seems to start reverting (Cubric, 2013), there is still a long way to go.

Although there are several studies focusing on the teaching of agile methodologies (e.g. Devedzic & Milenkovic, 2011; Lu, & Declue, 2011), “the literature on teaching agile project management is just starting to emerge” (Cubric, 2013, p.121). Mahnic (2010; 2012) describes a course designed to teach Scrum and project planning to undergraduate students, concluding that the best way to teach agile is through projects and practical work. In addition, Cubric (2013) proposes a new method for teaching agile project management and found positive results with respect to the degree of learning acquired by students.

3. Description of the activity

3.1. Purpose

The expected product outcome of the activity was a flowerpot with a plant. Figure 1 shows the material packs that were given to students.



Figure 1. Material packs (one per group), ready for starting the activity.

3.2. Setting up team members

The 40 students enrolled in the Project Management course were grouped in groups of 4. Because when conducting this activity students were already working in teams in another research project, the teams for this activity were the same as the ones already established.

Within each group, different roles were assigned:

- 1 **product owner** (PO), representing the end customer and/or other stakeholders and responsible for:
 - Defining the requirements and the ROI of the product
 - Prioritizing
 - Validating
 - Defining *what* needs to be done, but not *how*
- 3 **team members**, representing a collection of individuals working together. Particularly, team members were expected to:
 - Build and deliver the requested and committed product increments at each sprint
 - Adhere the same norms and rules, showing respect to each other
 - Collaborate
 - Self-organize themselves

The instructor of the course was assigned to be the **scrum master**. Her role was to act as a PO facilitator and ensure all teams had what they need to get the job done.

Ideally the POs should have taken all decisions individually, but given the instructional objective of the activity, decisions were jointly discussed and agreed with the whole class.

3.3. Setting up the project

The first task of POs was to create the product backlog. In scrum, the predominant way to express features on the agile product backlog is in the form of user stories. These are short, simple descriptions of the desired functionalities told from the perspective of the person who desires the new capability (usually, the user or an internal customer of the system). They typically follow a simple template:

As a <type of user>, I want/need <some goal> so that <some reason>.

User stories were written on sticky notes and latter arranged on the blackboard to facilitate planning and discussion. Once user stories were created, the teams drafted the acceptance criteria (define when each of the user stories would be considered to be done). These criteria, also called as conditions of acceptance or story requirements, should be testable and easy to evaluate (with a simple “yes” or “no” answer). Next step consisted in prioritizing user stories and in assigning story points. Story points represent how hard it is

for team members to complete the story. In this context, hard refers to complexity, effort and/or uncertainty.

By way of example, Table 1 shows the product backlog that was agreed, so that all teams had the same scheme to follow.

Table 1. Product backlog.

Order	User story	Story points
1	As a user I want to have all the necessary material to start the project	2
2	As a user I need to create a seedbed that allows planting flowers	5
3	As a user I want to have a nice and ornamented flowerpot	10
4	As a user I need the pot with soil to sustain the plant	3
5	As a user I need a flower to plant	5
6	As a user I need to plant the flower	5
7	As a user I need the flowerpot + the plant to look gorgeous	5

Lastly, agreement in the length of the sprints (development cycle or iterations) was reached. Each sprint was limited to 10 minutes. Likewise, with the whole class it was fixed that the maximum amount of story points that could be supported in a sprint was 10.

3.4. Project development

For illustrative purposes, in this section we describe how the first two sprints were conducted. Subsequent sprints followed a similar structure. The activity finished when the product was completed (after 5 sprints).

Sprint 1

Given the limitation of 10 story points per sprint, POs with their teams decided that the first sprint would only include the first two user stories, as in the example:

- As a user I want to have all the necessary material to start the project (2 points)
- As a user I need to create a seedbed that allows planting flowers (5 points)

Before starting with the sprint, the instructor provided details on how daily stand-ups usually work. These, are meetings in which attendees typically participate while standing. The discomfort of standing for a long period is intended to keep the meetings as short as possible. Due to the limited time assigned to each sprint, stand-ups were not conducted.

At the end of the sprint, the “review” ceremony was performed. In this meeting, the POs of each group decided which of the user stories were “done”, following the acceptance criteria defined before. Figure 2 shows how the classroom was arranged for the activity.



Figure 2. Project development.

Sprint 2

Following the example in Table 1, the second sprint focused on the user story ranked third (*As a user I want to have a nice and ornamented flowerpot*). Because this activity had 10 story points, this sprint was entirely devoted to accomplish this story.

Half way through the sprint and following the scrum methodology, a refinement meeting called product backlog grooming (in reference to keeping the backlog clean and orderly) was held. The outcome from this meeting was a clear consensus to break down this user story because it was too big (the initial estimation was too optimistic). Accordingly, the user story was divided into two: the first part should be finished by the end of this sprint, while the second part was moved to the next sprint.

This iteration concluded with the sprint review and the sprint retrospective. In the former, the review looked at what the team was building. In the later, the ceremony was led by the scrum master, and teams discussed the gains and pains of the just-concluded sprint in order to determine if anything needed to be changed to make the next sprint more productive. Resulting from this meeting, some story points were adjusted. Also, potential conflicts between team members were addressed in order to align the project's goal with team members' actions and commitment.

4. Assessment and results

Once the final product was obtained (see Figure 3), a debriefing session was held, consisting in a review of the fundamentals and principles of agile methodologies. Students were encouraged to share their experiences during the activity and link their perceptions with the pros and cons of this methodology. Because students played different roles, they were also able to experience the responsibilities each role entailed and deeply understand their participation in the various ceremonies of the scrum methodology.



Figure 3. Final products.

This session was also an excellent opportunity to discuss students' opinions and gather their suggestions for improvement. Aiming at formally capturing students' feedback, an anonymous survey was designed. Table 2 displays the results.

Table 2. Students' feedback (scale from 1 – lowest to 5 – highest)

Questions	Average	SD
The activity was well organized, prepared and structured	4.27	0.90
The lecturer encourages student to participate in the activity	4.27	1.01
The instructions of the activity are clearly communicated by the lecturer	4.55	0.69
Teaching resources were appropriate in that they facilitate learning	4.64	0.67
This activity has helped me improve my knowledge, skills, or attitudes	4.36	0.81

As it can be observed, all items in the survey were highly evaluated (>4, in a 1 to 5 scale). The most outstanding items were the appropriateness of the resources for the learning process, and the way in which the instructor communicated the instructions of the activity. It is also remarkable that students converged in the usefulness of the activity as a means to improve their knowledge in this topic.

5. Discussion and conclusion

This paper describes the details of an activity carried out during the fall semester of the academic year 2016/17 in a course of Project Management. In order to prepare students for the increasing use of agile methodologies in industry, this activity was designed exposing students to agile methodologies, and scrum in particular.

Survey results confirm that students showed a positive attitude towards learning agile methodologies through practical project work. It becomes evident that students were enthusiastic about the practical approach used in the activity. We hope these results encourage other lecturers to design similar activities.

One limitation of this experience is that, although being a hands-on activity, the main output was building a flowerpot with a plant. Future editions might consider designing project activities that are more close to real world industrial environment, this way students would experience challenges similar to those project managers face in their daily routines. Forthcoming instructional experiences might also consider expanding this activity to other agile methodologies such as XP, which has been proven to be very effective when combined with scrum. Likewise, students' performance in the form of grades might also be useful in order to test whether the knowledge acquired has been assimilated.

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In Search of Reusable Educational Resources in the Web

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Abstract

Nowadays there is a high demand from teachers to precisely find online learning resources that are free from copyright restrictions or publicly licensed to use, adapt and redistribute in their own courses. This paper investigates the state of the art to support teachers in this search process. Repository based strategies for dissemination of educational resources are discussed and critiqued and the added value of a semantic web approach is shown. The ontology schema.org and its suitability for semantic annotation of educational resources is introduced. Current ways and weaknesses to discover educational resources based on appropriate semantic data are presented. The possibility to use the wisdom of the crowd of learners and teachers defining semantic knowledge about used learning resources is addressed. For demonstration purposes within all sections the course subject 'Semantic SEO', dealt in the course 'SEO – Search Engine Optimization' held by the author in 2016, is used.

Keywords: *semantic web; educational resources; schema.org; LRMI; semantic SEO.*

1. Introduction

To improve student learning in their courses teachers more and more frequently use a special type of blended learning and flip their classrooms. A flipped classroom shifts instruction to a learner-centered model abroad the classroom whereas during class time topics are explored in greater depth and meaningful learning opportunities are created (Tucker, 2012). For self-study outside the classroom teachers deliver educational resources to their students online. Scholarly articles, digital documents, blogpostings, video-objects, audio-objects, books and other learning resources are offered to the students mostly via a website or a learning management platform. During class they use learning resources like case studies, assessments, work group instructions or role playing games too.

However, learning resource creation is very time consuming and appropriate high quality educational resources have been already created by others in many cases. So reuse of existing materials as they are, adapted or incorporated into own materials is highly desirable for teachers designing or updating their courses. Thus teachers search on the Web for appropriate and open to use educational resources to integrate them into their individual courses.

Web search engines make access easy but the vastness of material available makes it very challenging for a teacher to find educational resources to address their specific student needs (Yu L., 2014, p 505). Let us say we are looking for high quality text suited to introduce students into the subject of 'semantic SEO'. Google lists more than 500.000 results for 'semantic SEO'. There are too many irrelevant results and the process of browsing through thousands of potential hits to find the ones that meet the specific needs are very time consuming. Also Google Scholar results for 'semantic SEO' are not well suited too because resulting scholarly articles are usually too high sophisticated for introduction purposes.

This means that there is a high demand for teachers finding reusable educational resources more precisely. This paper demonstrates capabilities and investigates further enhancements to improve teachers search performance especially using possibilities of the Semantic Web.

Section 2 of this paper investigates and criticizes present technology strategies for dissemination of content as educational resources and shows the added value of a Semantic Web approach. Section 3 focuses on *schema.org* ontology to semantically describe learning resources and also shows how to disseminate corresponding structured data. Section 4 focuses on semantic discovery of educational resources and shows how to use customer defined search engines for this purpose. Section 5 summarizes results and identifies discovered weaknesses. For demonstration purposes within all sections the course subject 'Semantic SEO' dealt in the course 'SEO – Search engine optimization' held by the author in 2016, is used.

2. Strategies for Educational Resource Semantic Description and Dissemination

(Barker & Campbell, 2016) illustrate a range of technical approaches employed to disseminate educational resources. Present technology strategies include institutional repositories and websites, subject specific repositories, sites for sharing specific types of content (such as video, images, ebooks), general global repositories and also services that aggregate content from a range of collections.

As examples (U-Now), (MIT OCW), (OpenSpire), (BBC) or (OpenLearn) *are institutional repositories*. *Subject specific repositories* and aggregators like (Humbox), (Kritikos) or (CORE-Materials) are generally designed to support subject discipline communities across multiple institutions. The materials come from a variety of sources mostly associated with UK higher education, some industry, third sector and overseas organizations. They host particular domain specific resource types and use specialized resource descriptions vocabularies. Some repositories have means of syndicating information about their resources to aggregators, but the emphasis placed on syndication varies.

Content type specific repositories such as YouTube, iTunesU, SlideShare, Scholar, Flickr and expert's blogs are currently the most popular and successful repositories of learning materials. These platforms each focus on a single media type like video, audio, presentations, images or texts and tend to make resources available for all to view. Due to their popularity and ubiquity, these sites set user expectations for the dissemination and delivery of learning resources on the web and are more sustainable than the education sector services and institutional repositories mentioned before.

Global repositories and aggregators like (MERLOT), (Solvonauts) or (OER Commons) are not limited by subject or resource type and include links to tens of thousands of peer reviewed educational resources. Their geographic scope is global, however there is a preponderance of material from the US and UK. There have been many benefits but there still exists a significant barrier to finding educational resources. Teacher's awareness of educational resource repositories is still limited. They favor web search engines but a central search across several repositories has not been available yet. If a teacher is aware of a repository, most metadata he can find there is about the content itself and not about its educational use and quality (e.g. see <http://bit.ly/2j7f7Ki>). Essential learning resource criteria like level of quality, actuality, rating value, level of complexity, learning time or intended audience cannot be considered to find appropriate results (Yu L., 2014, p.507f). Thus, current repositories are falling short of meeting user's expectations in terms of adequate support for finding appropriate content (Dichev, C., Dicheva, D. , 2012).

As a result no appropriate educational resource could be found for 'semantic SEO' neither in MERLOT nor Solvonauts or OER Commons. Browsing Scholar and expert's blogs some

suited learning resources for ‘semantic SEO’ could be found after a while of search. However, results were found more by accident than by structured search.

The basis for successful resource discovery and retrieval are common vocabularies for meta descriptions that meet user’s expectations and widespread popular tools considering these descriptions. The number of formal meta data standards have emerged over the last decade which attempt to address the issue of educational resource description. A comprehensive description and analysis of learning resource metadata standards is presented in (Dietze, et al., 2013). There are two broad strategies behind learning resource metadata (Barker & Campbell, 2016, p. 67):

- The “traditional” approach of creating catalog records which separate the metadata from the resource, creating a self-contained stand-alone metadata record that fully describes the resource. As we outlined above repositories using this approach did not really take hold.
- Augmenting web resources with semantic information to assist web search engines and other services the discovery and optimal presentation of learning resources based on their meta data. The *schema.org* initiative has been viewed as a signal of mainstream support for the idea of the semantic web (Yu L. , 2014, p. 475 ff) and we will discuss its strengths and weaknesses for educational resource dissemination and discovery in more detail in section 3.

3. Schema.org and Educational Resources

Schema.org is a joint effort by Google, Bing, Yandex, and Yahoo! launched in 2011 providing a common vocabulary for describing a wide variety of entities which can be found in the Web. At this point in time the *schema.org* contains more than 580 classes to describe the most popular types of web content. The goal of *schema.org* has been to let content publishers embed common machine readable information into their HTML pages in form of microcode, RDFa or JSON-LD. This makes web search engines semantically understand the content and therefore better search results are achievable (Mika, 2015).

In the past years the *schema.org* effort proved to be a success. Publishers have a standard vocabulary now to semantically annotate the same kind of information and tools have been developed to support the annotation process (e.g. www.schemaApp.com). Validators improved: Googles structured data testing tool (<https://search.google.com/structured-data/testing-tool>) is offered by Google to support authors in metadata tagging their content; Content management tools like Wordpress and Drupal extended to automatically produce *schema.org* markup; Semantic search engine optimization became topical.

Since the initial effort in 2011 the *schema.org* vocabulary kept evolving. The Learning Resource Metadata Initiative (LRMI) is a collaborative initiative that has been working since June 2011 to make it easier for teachers and learners to find educational materials using major search engines and specialized resource discovery services (Barker & Campbell, 2014). In 2013 LRMI added missing classes and properties to the core of *schema.org* that make the discovery of learning resources easier (Barker & Campbell, 2014b) now.

Figure 1 shows an abstracted excerpt of *schema.org* vocabulary focusing on LRMI classes and properties. Different kinds of *CreativeWork* in the Web, e.g. *Articles*, *Books* or also *Websites* or *MediaObjects* can be seen and tagged as educational resources with properties like their intended educational use, age range or language. *BlogPosting* and *ScholarlyArticle* specialize *Article*. A *CreativeWork* can be addressed to a certain *Audience*, which can also be an *EducationalAudience* of a special type and role. A *Review* is also a *CreativeWork* about another *CreativeWork* describing and rating it. Via its *educationalAlignment* it is possible to assign a *CreativeWork* to an *AlignmentObject* within an intended *educationalFramework*. As an example figure 2 shows the JSON-JD representation of a *Review* markup of a *BlogPosting* item (see website source code of <http://bit.ly/2pNFGn1>).

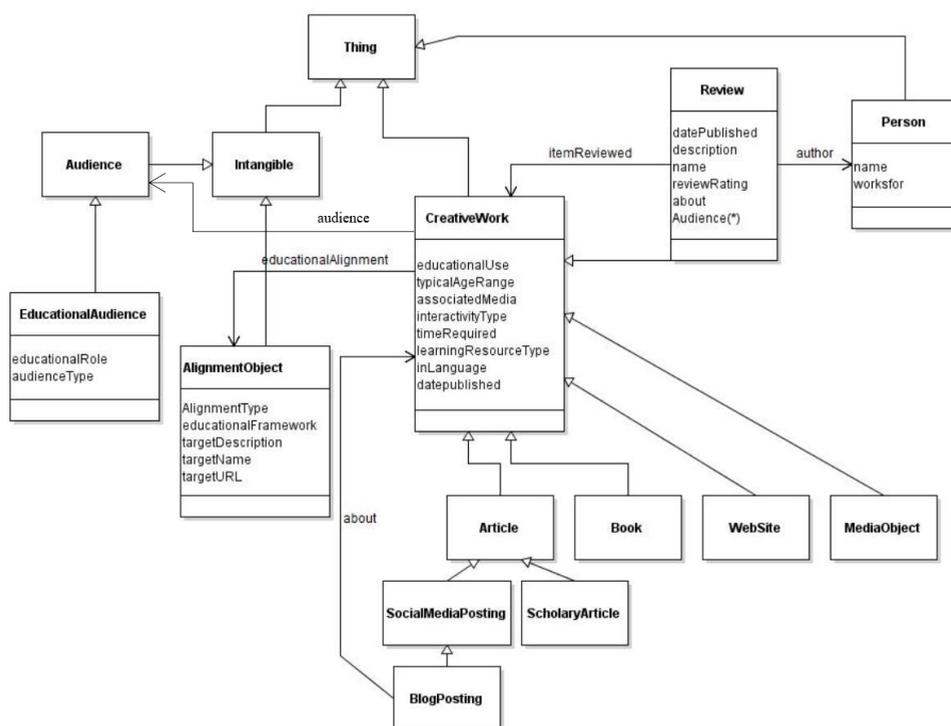


Figure 1 – LRMI vocabulary excerpt of *schema.org*.

```
{ "@context": "http://schema.org",
  "@type": "review",
  "author": { "@type": "Person",
    "name": "Claudia Steinberger"},
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  "name": "Introduction into Semantic SEO",
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    }
  }
}
```

Figure 2 – JSON-LD structured data about reviewing a Blog posting

One problem became evident to the author when tagging educational resources: most of LRMI *schema.org* properties have text as expected type but no common possible values are defined. This makes a consistent common markup difficult despite of a common vocabulary and subsequent retrieval across different providers almost impossible.

4. Semantic Discovery of Educational Resources

Some holders of educational resources like (BBC) have started to use *schema.org* to markup their materials (Mikroyannidi, Liu, & Lee, 2016). Also some repositories like (MERLOT) have started to add also *schema.org* metadata to their learning resources. Looking at semantic scholar (<https://www.semanticscholar.org>) it becomes evident that *schema.org* is present there too. Search results are tagged as ScholarlyArticles but LRMS-classes and properties are used there insufficiently or not at all.

Schema.org has been applied widely in the last years mainly for semantic search engine optimization purposes. At the moment structured data embedded on webpages are used from search machines automatically but limited. For instance Google Search only uses

special *schema.org* classes (e.g. People, Product, Recipe, Event) to generate Rich Snippets in their search results. This form of use also influences the way and willingness of content authors to tag their contents. For example structured data describing ‘educationalUse’, ‘learningResourceType’, ‘timeRequired’, ‘educationalUse’ or ‘educationalAlignments’ are ignored by Google Search at the moment. To manually query the semantic web Google Custom Search Engines (CSE) can be used. It is very simple to filter on *schema.org* classes in a CSE but to query properties complex queries are necessary. The CSE query language for *schema.org* is not well documented at the moment and complex to use for teachers. Semantic scholar tackles this problem offering a simple user interface to query ScholarlyArticle properties which should be done for Google Search too. It also does not become clear which *schema.org* properties are indexed by Google at all.

5. Summary and Outlook

The common vocabulary to describe educational resources is available in the form of *schema.org*, tools have been developed to support and test the annotation process. But still the following weaknesses could be identified:

- (1) Content providers are willing to tag their content with structured data that bring a clear benefit to them. At the moment this is only the case for search engine optimization purposes for special classes and properties (e.g. Products, Events, Persons and Organizations) but not for the LRMI extension of *schema.org*.
- (2) Possible values for LRMI *schema.org* properties with text as expected type have to be defined commonly to enable search across different providers.
- (3) Not only content authors but also content users (teachers, students) have to be motivated to tag their experiences using educational resources. As an example Figure 2 shows structured data that is added to a teachers Blogposting recommending an educational resource (see <http://bit.ly/2js9jd8>). This knowledge of the crowd could be searched for by others too to find appropriate learning resources for their own courses.
- (4) All *schema.org* classes and properties should be indexed by the major search engines and easy to handle tools have to be developed or made available by search machine providers to individually query all classes and properties.

We can expect research and development within this fields during the next years to support teachers to precisely find appropriate educational resources.

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The Effect of Engineering Education Accreditation on Materials Engineering Education in University of Seoul

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Abstract

Korea implemented the Engineering Education Accreditation system in 2001, and it was adopted by 85 engineering colleges (out of 165) in 2015. Focusing on the Department of Materials Engineering at the University of Seoul, this study performed a time-series analysis of Grade Point Average (GPA), employment rate, and credits earned in Mathematics, Science, Computer (MSC)/design/major courses to compare the differences in academic achievements between accredited and non-accredited graduates. The results showed that accredited graduates had a generally higher GPA and employment rate than non-accredited students, and this can be traced to the curricula provided under the accreditation system having a positive effect on improving communication, teamwork, and creativity.

Keywords: *Engineering Education Accreditation; Materials Engineering; Engineering Education*

1. Introduction

The Accreditation Board for Engineering Education of Korea (ABEEK) has performed accreditation every year for engineering education, beginning with two universities in 2001. According to the annual report of 2015, 549 programs in 85 out of 165 engineering colleges received accreditation as Engineering Accreditation Commission (EAC) or Computing Accreditation Commission (CAC). By major, the 549 accredited programs include 114 in electrical engineering, 85 in mechanical engineering, 51 in civil engineering, 51 in chemical engineering, 44 in architectural engineering, and 41 in materials engineering. These six engineering majors make up about 70% of all programs, and the field of materials engineering accounts for a significant 7.5%.

Despite the increase in the number of accredited engineering programs and accredited graduates, the accreditation system has received criticism. Some universities have not participated or are choosing to abolish accreditation, and the effectiveness of the accreditation system is under question. The reasons include the constraint on autonomous operation, the 2-3 year frequency of evaluations, lack of professional evaluators, increased burden on faculty, and lack of benefits for graduates of accredited programs (Cho, 2012). Students' feedback on accredited programs indicates that the fulfillment of program credits leaves them with fewer options for other courses, and that they do not benefit much from mandatory, intensive activities such as team projects and preparation of design reports.

With the government enforcing Engineering Education Accreditation and announcing related policies, it is essential to perform a comprehensive evaluation of the effectiveness of the accreditation system in enhancing the competencies of students. The microscopic effects of accreditation should be assessed from the perspective of departments implementing such programs. The basic goal of the accreditation system, that is, to foster talent in engineering and technology to meet the demands of industries and society, must also be reviewed.

Against this backdrop, this study analyzed the effects of Engineering Education Accreditation based on GPA and employment rate of accredited and non-accredited graduates of the Department of Materials Engineering at the University of Seoul, which has implemented the accredited system for ten years.

2. Theoretical Background

The Engineering Education Accreditation system is not mandatory, and universities can choose to adopt the system or not. Engineering education programs satisfying accreditation criteria are granted accreditation status, and are encouraged to continue innovative efforts to improve program quality. An engineering program seeking to earn accreditation status must be operated by a four-year university that offers a bachelor's of engineering, and satisfy criteria such as educational objectives, learning outcomes, curriculum, and CQI. In addition, the program should be designed to be demand-oriented and performance-centered. Under ABEEK guidelines, materials engineering majors of accredited programs must fulfill a requirement of at least 30 MSC credits and 9 design course credits.

The Engineering Education Accreditation system was first implemented in 2001, and its effectiveness and achievements have not been widely studied. Recently, research has focused on the effects of the Engineering Education Accreditation system (Kang, 2012), performance of accredited programs (Park, 2015), effect of accreditation on graduate employment rates in the same field as their majors (Kim, 2014), difference in employments rate between accredited and non-accredited graduates (Jeon, 2013), the effects of accreditation on curriculum in engineering education (Cho, 2012), and the relationship between engineering students' course grades and Korea Collegiate Essential Skills Assessment (K-CESA) core competencies. While these studies are meaningful in examining general performance or trends of the accreditation system for a specific sample of graduates based on survey responses by graduates, faculty and industry personnel, they have been inadequate in providing an analysis of microscopic performance or performance over time at the program level, which is the basic operating unit of the accreditation system. As such, this study seeks to analyze the effects of the accreditation system on a specific department (Department of Materials Engineering).

3. Method of Analysis

First, in determining the number of four-year universities offering a materials engineering major and the accreditation status of materials engineering programs, this study integrated Semiconductor, Ceramics, Materials, Advanced Materials, and Metallurgical Engineering departments under the broad field of materials engineering based on data provided by the Engineering Education Information Center (<http://www.eeic.or.kr>) and ABEEK (<http://www.abeek.or.kr>).

Second, to assess the effects of Engineering Education Accreditation on department education, this study conducted a time-series analysis of the achievements of accredited and non-accredited graduates from the Department of Materials Engineering at the University of Seoul. The analysis, focusing on accredited and non-accredited graduates from 2009 to 2014, covered differences in GPA, employment rate, MSC, design courses, and major courses.

4. Results

4.1. Statistics on Materials Engineering Graduates of Four-year Universities and Graduates of Accredited Programs in Korea

Figure 1 shows the number of graduates produced from accredited materials engineering programs of ABEEK from 2010 to 2014. The number of graduates grew more than twofold in four years, from 436 in 2010 to 1,101 in 2014. These accredited graduates account for about 24% of the total number of materials engineering graduates of four-year universities, which amount to approximately 4,500.

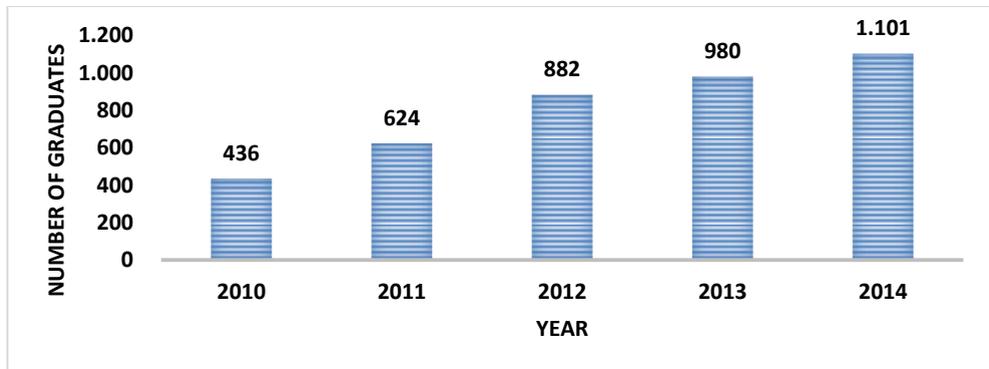


Figure 1. Number of graduates produced from accredited materials engineering programs.

4.2. Comparison of Academic Performance of Accredited and Non-accredited Graduates of the Department of Materials Engineering at the University of Seoul

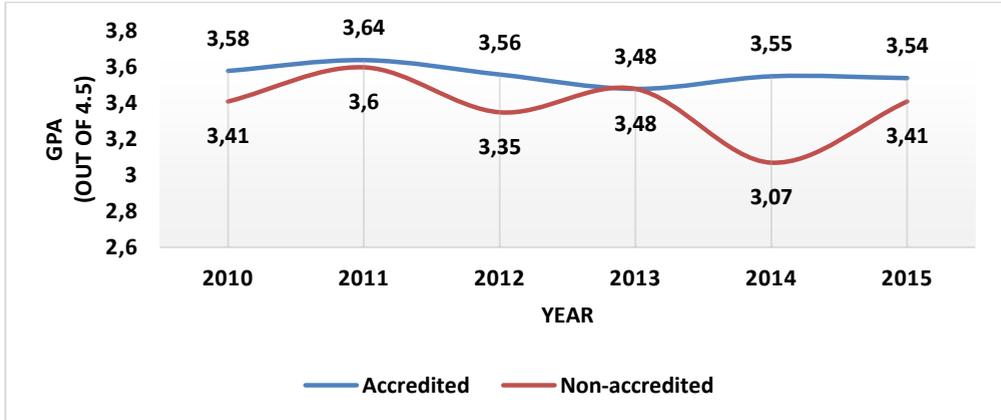


Figure 2. Comparison of GPA between accredited and non-accredited graduates by year.

Figure 2 shows the GPA of accredited and non-accredited graduates by year. Accredited graduates had a slightly higher GPA than non-accredited graduates in all years except for 2013, when the two groups performed similarly. The difference was most prominent at 0.48 in 2014. The reason for the similar performance in 2013 between the two groups is the small number of non-accredited graduates in that year (only 5 out of 32 were non-accredited). As such, the difference of GPA in 2013 between accredited and non-accredited graduates cannot be considered significant.

Figure 3 shows the employment rate of accredited and non-accredited graduates by year. The employment rate of accredited graduates was higher by a minimum of 5% and a maximum of 67% through the research period (2009-2016), indicating that the intensive new materials engineering program at the University of Seoul has boosted employment among graduates. This is consistent with the results reported by Kim et al. In 2013, the employment rate of accredited and non-accredited graduates was 85.2% and 80.0%, respectively. The small difference compared to other years can be traced to the small number of non-accredited graduates in 2013, and their similar GPA to that of accredited graduates.

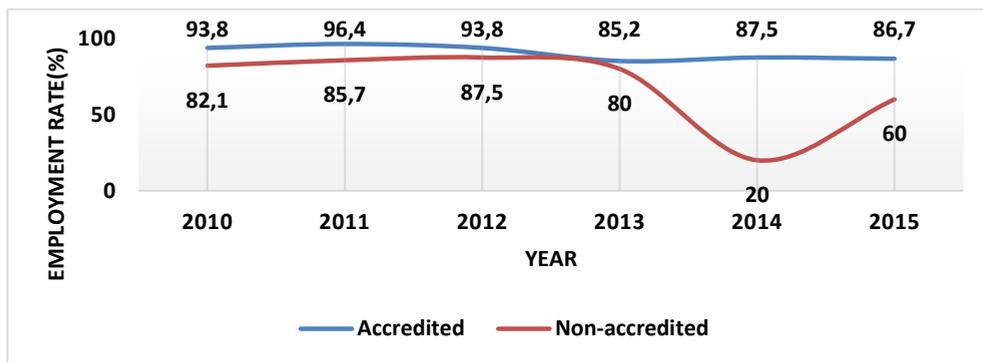


Figure 3. Comparison of employment rate between accredited and non-accredited graduates by year.

Figure 4 shows the fulfillment of MSC credits between accredited and non-accredited graduates by year. Accredited graduates completed 2.5 credits to 14.4 credits more in MSC courses than non-accredited graduates. Accredited graduates completed about 30 MSC credits each year, which is the minimum requirement for graduation. On the other hand, non-accredited graduates earned fewer credits since courses such as Engineering Mathematics 1 and 2 were not mandatory. This is presumed to be related to the gradual decline in employment of non-accredited graduates, as shown in Figure 3.



Figure 4. Comparison of fulfillment of MSC credits between accredited and non-accredited graduates by year.

Figure 5 shows the fulfillment of design course credits between accredited and non-accredited graduates by year. The Department of Materials Engineering at the University of Seoul requires non-accredited students to complete at least six credits in Introductory Design and Capstone Design, which are designated as mandatory courses, and accredited students to earn an additional 9 credits in design courses. Accredited students earned at

least 15 credits in design courses to meet graduation requirements, whereas non-accredited students earned between 3.4 to 9.1 credits after 2013. The difference between the two groups grew larger over the years.

Design courses are effective in enhancing creativity, teamwork, and communication skills. Past research has shown that students who complete more design courses tend to have a better chance of employment⁷⁾. The decrease in the fulfillment of credits for design courses among non-accredited graduates after 2013 is likely related to their decline in employment rate.

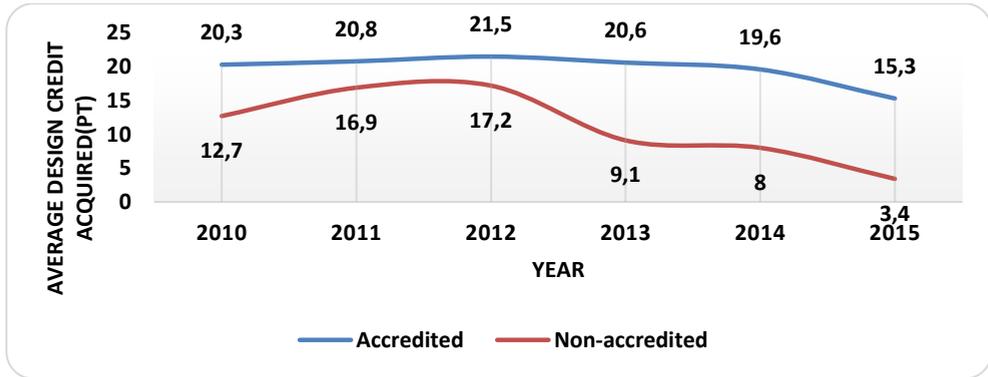


Figure 5. Comparison of fulfillment of credits in design courses between accredited and non-accredited graduates by year.

Figure 6 shows the fulfillment of major course credits between accredited and non-accredited graduates by year. Both groups must complete at least 60 credits in major courses to successfully graduate. The graph shows that non-accredited students fulfilled the minimum number of credits, while accredited students surpassed the requirement and earned more than 70 credits. This means that non-accredited students took fewer MSC and design courses, and completed other courses that are less helpful in gaining employment in order to meet graduation requirements.

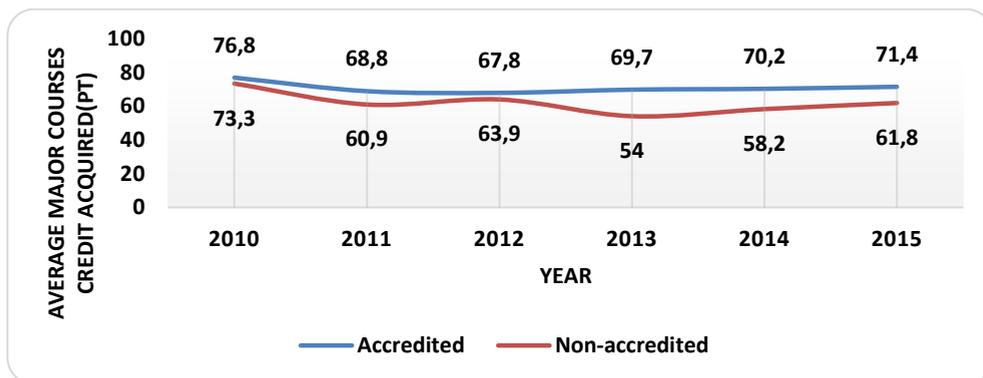


Figure 6. Comparison of fulfillment of credits in major courses between accredited and non-accredited graduates by year.

5. Conclusion and Discussion

This study performed a comparative analysis of GPA, employment rate, and completion of credits (MSC, design courses, major courses) between accredited graduates and non-accredited graduates of the Department of Materials Engineering at the University of Seoul, which has implemented the accredited system for ten years. The following conclusions were derived.

Throughout the research period (2009-2016), accredited graduates had a higher GPA than non-accredited graduates. The employment rate of accredited graduates was also higher, by 5.2-67.5%.

With the implementation of the Engineering Education Accreditation system, the intensive program in materials engineering at the University of Seoul encouraged students to complete more credits in MSC, design, and major courses. Based on past research on the relationship between courses and student competency, such courses are expected to have enhanced their communication skills, teamwork, and creativity. Ultimately, the program can be considered as having produced talented individuals in materials engineering who possess advanced knowledge and skills, thereby improving their employment rate.

The above results demonstrate that the accredited program offered by the Department of Materials Engineering at the University of Seoul has a positive effect on the employment rate of students.

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Rubrics use and in-class feedback in higher education: Students' perceptions and their effect on academic achievement

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Abstract

This study examines students' views regarding two types of feedback: that obtained through rubrics and that given by the class tutor (rubrics and in-class feedback, respectively). We constructed an ad hoc questionnaire to assess students' perceived usefulness of both types of feedback. The sample comprised 135 undergraduates from the University of Barcelona who were enrolled in a Research Designs course as part of the degree in Psychology. On almost all the questionnaire items the percentage of positive views was high for both types of feedback, although especially for in-class feedback. As for academic achievement, we observed no statistically significant differences between those students who only used rubrics, those who attended feedback classes and those who received both types of feedback. However, the latter left fewer questions unanswered in the multiple-choice exam, as compared with their peers who only used rubrics. Finally, those students who felt that the use of rubrics and feedback classes had helped them feel less anxious about exams obtained higher grades.

Keywords: *rubrics; in-class feedback; academic achievement; higher education.*

1. Introduction

Recent research has highlighted the importance of feedback for improving learning (Hodgson & Pang, 2012; Núñez-Peña et al., 2015; Panadero & Jonsson, 2013). There are two ways in which students can receive feedback: through rubrics and directly from the tutor in class. Studies have suggested that in-class feedback provided by tutors can help students to develop their learning (Hattie, 2013; Panadero & Romero, 2014). However, a recent study by Sáiz and Bol (2014) showed that the use of rubrics is equally as efficient.

Rubrics are an assessment tool that provides feedback regarding students' performance of tasks (Jonsson & Svingby, 2007). Research has concluded that approaches to instruction which help students to develop their self-assessment skills can facilitate learning (Efklides, 2012; Hodgson & Pang, 2012; Panadero et al., 2012; Sáiz et al., 2012). A further advantage of rubrics is that they can help students to monitor and assess their progress in a task both during its execution and upon completing it (Panadero & Jonsson, 2013). The frequent use of tasks that can be assessed by rubrics, coupled with detailed feedback from tutors is therefore key to high-quality learning. Indeed, it has been shown that continuous assessment with error feedback increases its benefits, especially when rubrics are available (Morales, 2009).

In light of these previous findings, we were interested in determining which kind of feedback would be more useful for improving students' learning: rubrics or personalized in-class feedback. To this end, we first examined students' perceptions regarding the utility of the feedback given in class and that received through rubrics. We then studied the influence that both types of feedback have on academic achievement.

2. Methods

2.1. Participants

Participants were 135 undergraduates from the University of Barcelona who were enrolled during the 2015-2016 academic year in a Research Designs course as part of a degree in Psychology. The sample comprised 99 women (73.3%) and 36 men (26.7%) with a mean age of 21.9 years (standard deviation 5.1, range 18-50).

2.2. Materials

Rubrics were used for each practical exercise in the Research Designs course. These rubrics were developed through consensus among all course tutors. During the 2014-2015 academic year all the rubrics used were validated in a sample of 36 students. Percentages of agreement between students' self-assessments, assessment by peers and tutor assessments was above 66%.

At the end of the course, participants were asked to complete a questionnaire designed ad hoc to assess the perceived usefulness of both types of feedback (Table 1).

Table 1. Questionnaire items regarding the perceived usefulness of rubrics and in-class feedback.

Items about rubrics	Items about in-class feedback
Item 1. The rubrics helped me to prepare for the course.	Item 9. The feedback classes helped me to prepare for the course.
Item 2. My learning improved as a result of the rubrics.	Item 10. My learning improved as a result of the feedback classes.
Item 3. The rubrics gave me a better understanding of the assessment criteria.	Item 11. The feedback classes gave me a better understanding of the assessment criteria.
Item 4. Through the use of the rubrics I learned to self-assess my performance.	Item 12. Through the feedback classes I learned to self-assess my performance.
Item 5. The rubrics helped me to feel less anxious when preparing for the exam involving open questions.	Item 13. The feedback classes helped me to feel less anxious when preparing for the exam involving open questions.
Item 6. The rubrics helped me to feel less anxious when preparing for the multiple-choice exam.	Item 14. The feedback classes helped me to feel less anxious when preparing for the multiple-choice exam.
Item 7. Overall, I think the rubrics were really useful.	Item 15. Overall, I think the feedback classes were really useful.
Item 8. I would like it if there were rubrics for the practical and project work of all the other courses on my degree.	Item 16. I would like it if there were feedback classes for the practical and project work of all the other courses on my degree.

2.3. Procedure

At the beginning of the course the rubrics were uploaded to the course website. During the course, the tutor provided specific feedback following each practical class. Prior to the end of the course, those students who had used the rubrics and/or attended the feedback classes were asked to complete the questionnaire. At the end of the course, all students sat two exams: one involving open questions and another in the form of a multiple-choice test in which the correct answer had to be chosen from among four alternatives. In order to discourage random guessing in the multiple-choice exam, students were told that incorrect answers would carry a penalty of 0.25 marks.

3. Results

Tables 2 and 3 show that for both types of feedback a high percentage of students perceived it to have been useful, although this was especially the case for in-class feedback.

Table 2. Percentages of responses given to each questionnaire item about the perceived usefulness of rubrics.

Items	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Item 1	0.9%	7.5%	33.0%	45.4%	13.2%
Item 2	0.9%	12.3%	36.8%	42.5%	7.5%
Item 3	1.9%	1.9%	7.5%	51.9%	36.8%
Item 4	3.8%	6.6%	21.7%	52.8%	15.1%
Item 5	10.4%	24.5%	33.0%	27.4%	4.7%
Item 6	7.4%	20.8%	32.1%	34.0%	5.7%
Item 7	0.9%	7.5%	24.5%	51.1%	16.0%
Item 8	2.8%	1.9%	17.9%	34.0%	43.4%

Table 3. Percentages of responses given to each questionnaire item about the perceived usefulness of in-class feedback.

Items	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Item 9	0.0%	2.3%	12.4%	48.9%	36.4%
Item 10	0.0%	2.3%	17.8%	45.0%	34.9%
Item 11	0.7%	3.9%	13.2%	43.4%	38.8%
Item 12	0.0%	4.6%	21.7%	41.9%	31.8%
Item 13	4.6%	21.7%	29.5%	27.1%	17.1%
Item 14	6.1%	18.6%	26.4%	35.7%	13.2%
Item 15	0.0%	2.2%	17.1%	48.1%	32.6%
Item 16	0.7%	0.8%	10.9%	41.1%	46.5%

We applied the Wilcoxon signed-rank test for related samples to the responses of those students who had both used rubrics and attended feedback classes (Table 4). This analysis showed that in-class feedback was viewed more positively than were rubrics for all the analysed aspects ($p < .02$), with the exception of the item about knowledge of assessment criteria ($p = .833$).

Table 4. Wilcoxon signed-rank test for related samples.

Differences	N of ranks			Z	p
	+	-	=		
Item 9 - Item 1	55	12	33	5.309	< .001
Item 10 - Item 2	59	12	29	5.955	< .001
Item 11 - Item 3	31	28	41	0.211	.833
Item 12 - Item 4	41	19	40	2.991	.003
Item 13 - Item 5	40	13	47	3.671	< .001
Item 14 - Item 6	32	15	53	2.342	.019
Item 15 - Item 7	43	15	42	3.933	< .001
Item 16 - Item 8	32	16	52	2.591	.010

Tables 5 and 6 show a positive correlation between a reduction in perceived test anxiety and the grades obtained, both with the use of rubrics (items 5 and 6) and with feedback classes (item 13 and 14). This significant correlation applies to both the open-answer and

multiple-choice exams. The negative correlation between the reduction in perceived test anxiety and the number of questions left unanswered in the multiple-choice exam was also significant. Moreover, for those students who used rubrics, a negative correlation was observed between the reduction in perceived test anxiety and the number of errors in the multiple-choice exam.

Item 7, referring to students' overall view regarding the utility of rubrics, was positively correlated with the grades obtained in the open-answer exam and negatively correlated with the number of questions left unanswered in the multiple-choice exam. Items 10 and 11, referring to students' views on whether feedback classes improved their learning and their understanding of assessment criteria, were positively correlated with performance in the open-answer exam. Item 12, referring to whether feedback classes helped students to self-assess, was positively correlated with the grades obtained in both types of exams, as well as with the number of correct answers in the multiple-choice exam. The correlation between item 12 and the number of errors made in the multiple-choice exam was negative. Finally, a significant correlation was observed between the need to include in-class feedback in other courses of the degree (item 16) and the grades obtained in the open-answer exam.

Table 5. Correlations between performance in the Research Designs course and response to the items referring to the perceived usefulness of rubrics.

Items	Exams				
	Open answers		Multiple choice		
	Mark	Mark	Hits	Errors	Unanswered questions
Item 1	.138	.050	.070	-.039	-.133
Item 2	.186	.093	.097	-.055	-.075
Item 3	.095	-.067	-.064	.047	.036
Item 4	.157	.118	.126	-.050	-.124
Item 5	.416**	.410**	.414**	-.290**	-.278**
Item 6	.351**	.399**	.404**	-.259**	-.295**
Item 7	.206*	.158	.175	-.033	-.209*
Item 8	.145	.010	.015	-.003	-.021

Note: * $p < .05$; ** $p < .01$

Table 6. Correlations between performance in the Research Designs course and response to the items referring to the perceived usefulness of in-class feedback.

Items	Exams				
	Open answers		Multiple choice		
	Mark	Mark	Hits	Errors	Unanswered questions
Item 9	.190	.050	.052	-.024	-.047
Item 10	.234*	.118	.109	-.135	-.005
Item 11	.201*	.038	.034	-.065	.021
Item 12	.408**	.309**	.296**	-.296**	-.101
Item 13	.334**	.309**	.329**	-.120	-.326**
Item 14	.289**	.311**	.331**	-.125	-.322**
Item 15	.138	.093	.095	-.070	-.054
Item 16	.235*	.098	.086	-.142	.028

Note: * $p < .05$; ** $p < .01$

Results from analyses of variance showed no statistically significant differences in academic performance between those students who only used rubrics, those who only attended feedback classes and those who used rubrics and attended feedback classes, this being the case for both the open-answer exam ($F(2,130) = 0.654$, $p = .522$) and the multiple-choice exam ($F(2,128) = 2.191$, $p = .116$). However, results from the Bonferroni correction showed that students who benefitted from both types of feedback left fewer questions unanswered in the multiple-choice exam, as compared with those students who only used rubrics ($p = .015$).

4. Discussion

Students felt that both types of feedback were useful for their learning, although of the two the most positive ratings were given to direct feedback from tutors. The analysis also showed that those students who reported feeling less anxious about exams as a result of using rubrics or attending feedback classes did better in their exams. This result is consistent with the findings of Andrade and Du (2005), Panadero et al. (2012) and Reynolds-Keefer (2010). These authors concluded that the use of rubrics helped reduce negative emotions such as anxiety, leading in turn to better performance. Finally, those students who both used rubrics and received in-class feedback left fewer questions unanswered in the multiple-choice exam, as compared with their peers who only used rubrics. This may indicate that when students receive more personalized in-class feedback,

they feel better prepared and more capable of succeeding in exams. Thus, feedback given by the tutor might boost students' confidence regarding their knowledge of the course content. Similar results were recently obtained by Núñez-Peña et al. (2015), who found a positive relationship between academic performance and perceived usefulness of in-class feedback. These authors concluded that giving in-class feedback about errors helped students to feel more confident about their learning ability, reducing — in a course with mathematical content — the negative impact of math anxiety on performance.

In conclusion, the results of this study show that approaches to teaching which involve feedback (both rubrics and in-class feedback) may lead students to have a more favourable view of their learning, especially when the feedback is given in a more personalized way, in class. Both types of feedback were able to reduce perceived test anxiety in students and, moreover, those students who reported feeling less anxious as a result of feedback did better in their exams. This suggests that both types of feedback can help students to approach assessment without the emotional tension that is usually associated with academic achievement.

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The relationship between demographics and the academic achievement of engineering students

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Abstract

The changing structure of student populations or cohorts over decades' produces changing academic achievements or results. This may be due to a number of factors, including the school education system, the political system and the sociocultural system. The aim of this paper is to analyse the relationship between student demographics and the academic achievement of undergraduate engineering students over a 15-year period. A descriptive study is used to determine the relationships between specific variables that existed between 1998 and 2013. These variables include gender, age and home languages of students that are contrasted to their final grade in a compulsory Design Projects module. Students need to obtain more than 50% to successfully complete this module, with the results indicating greater success for students with an Afrikaans or IsiZulu mother tongue than compared to students with a Sesotho, Setswana or Xhosa mother tongue. Younger students, less than 21 years of age, have a higher pass rate than older students who are more than 24 years of age. Finally, males outnumber females by more than 3:1. However, their final overall pass rates differ by only 3%, suggesting that both genders performed equally well in the Design Projects module. A key recommendation is to provide additional academic support to older students who may be struggling to synthesize knowledge and skills from a wide number of modules.

Keywords: culture, mother tongue, ages, gender, cognitive behavioural

1. Introduction

Confucius, a Chinese teacher, editor, politician, and philosopher once stated “By nature men are nearly alike; by practice men are wide apart” (Quotes, 2017). He was of the view that all infants are similar at birth and that one’s surroundings influence one to become an individual in a specific cultural group (Leveridge, 2008). More recent literature continues this discourse, noting that individuals are constantly shaped by their environment (VanderStel, 2014).

The careful compilation of student profiles may help to better understand students and their personal circumstances (Nel & Wilkinson, 2001), while serving as an early warning system (Stephens & Myers, 2013). Student profiles have also helped to tailor teaching practices to student identity and student strengths (Hoskyn, 2013). Student demography may further interact with teacher demography and may be jointly dependent with teacher experience (Tobe, 2009). Understanding the relationship between the demography of students and their academic achievement may therefore assist academics to improve their teaching practice.

The aim of this paper is to analyse the relationship between student demographics and the academic achievement of undergraduate engineering students in a design based module, Design Projects 3 (DP3). This is done for a 15-year period from 1998 to 2013, in order to try and understand how the student population and student academic achievement has changed in South Africa (SA) that faced political and economic changes during this time.

The paper firstly discusses student demographics (gender, age and language) in relation to academic achievement. The context and assessment of DP3 is then outlined followed by the research methodology. Results are presented in two tables and then conclusions are drawn.

2. Student demographics’ impact on academic achievement in higher education

Gender, age and language may impact on student academic achievement in higher education. A possible reason for this is that these factors influence human cognitive behaviour. The cognitive behavioural theory states that the three cornerstones namely thought, emotion and behaviour is co-dependent. For example, if one does a lot of engineering work (behaviour), one would think more about engineering (thought) and that would make one feel more like an engineer (emotion) and vice versa. This cognitive behaviour may have a negative result if stereotyping is introduced as stereotyping and cognitive behaviour is linked (Hamilton, 2015). For instance, if stereotyping influences a woman to think that she will not make a good engineer then thought and actual behaviour will be influenced.

Contradicting results in the relationship between gender and academic achievement might be a factor of the level of gender inequality in that particular society. Factors that seem to influence gender deviations includes stereotyping (Barbuto Jr, Fritz, Matkin, & Marx, 2007). Contradicting conclusions are seen in research that some show men perform better than women in certain fields and other times women outperform men. Others found no evidence of academic performance by gender (Richardson & Woodley, 2003; Mlambo, 2012).

Stereotyping is also indicated as a cognitive behaviour theory factor in age (Beck, 2006). In South Africa students should typically start at 19 years of age after completed their secondary education with a National Senior Certificate at an average age 18 years (Kruger & Sonono, 2016). Institutions of higher education have been viewed as facilities for qualified young people leaving secondary schools. However, with worldwide changes in educational policies, there seems to be a global increase in mature admissions. (Richardson & Woodley, 2003; Mlambo, 2012). Richardson and Woodley (2003) noticed from the literature that, in the UK, older students tended to do slightly poorer than younger students in the older universities and slightly better in polytechnics and colleges of higher education. Richardson (1994) further observed that mature students were more likely adopt a deep approach and a meaning orientation, while younger students adopted a surface approach or a reproducing orientation.

Cultural and environmental elements might have an influence on cognitive behaviour. A study showed that one's environment and culture impacts on the way an individual will learn, which correlates with old philosophies that infants are similar and that their surroundings influence their development (VanderStel, 2014). In SA, a language is often an indicator of a specific culture. A key challenge, in this regard, is the a multi-cultural and multilingual society in SA where 11 official languages exist. Education is primarily done in English, which results in the majority of students studying in their second or third language that puts students at a disadvantage (Jaffer, Ng'ambi, & Czerniewicz, 2007). The University of Cape Town revealed a 20% difference between the success rate of English first language and English second language students in 2002 (Spiegel et al., 2003). Swart and Kuriakose (2014) revealed that students from underdeveloped urban areas speaking Sesotho, Tsonga, Tswana and Zulu were among the majority of students who did not complete a module relating to work integrated learning. The effect of studying in one's mother tongue may seem to have a greater impact on one's thoughts, emotions and behaviour.

3. Context of this study

DP3 is a compulsory offering for the National Diploma: Engineering: Electrical qualification that requires a National Senior Certificate (including a minimum number of credits). This module is offered at the end of the course and requires students to synthesize their previously acquired knowledge in the design and construction of a working electronic project to address a specific engineering problem. Most engineering problems require a significant amount of background knowledge from a variety of fields (DiBenedetto, Hoerl, & Snee, 2014). Students have to therefore demonstrate a number of different graduate attributes, such as engineering knowledge, problem analysis, design and development of solutions, investigation, modern tool usage, teamwork, communication, project and management and finance skills (International Engineering Alliance, 2013). The purpose of DP3 is to develop a working electronic project that will help solve a specific problem in the community or in industry. Specific learning outcomes include a portfolio that consist of a proposal, schematics, printed circuit board (PCB), fault finding and presentations. Methods of assessment include formative assessment (feedback on the proposal, schematic and PCB) and summative assessment (final judgement on the presentation, portfolio and electronic project).

4. Research Methodology

A descriptive study is used in this research covering the time period from 1998 through 2013. This type of study has been used in the past to determine the relationships between specific variables, such as between cognitive impairment and self-management (Vehovec, Dolansky, Josephson, & Hughes, 2015). In this study, it is used to determine the relationship between the academic achievement (considered when students obtain 50% or more) of engineering students and their respective ages, gender and home languages. No sampling technique is used as all data analysed. The total sample size is 3700. All data was obtained from the universities' Integrated Tertiary System (ITS) department. Data relating to gender is presented separately, where home languages, age brackets, grade distributions, student number growths and final pass rates are contrasted. Home languages are listed alphabetically according to the number of languages identified. Different mother tongues may be used to indicate different and even opposite cultural backgrounds, political stands, values, and moral standards (Niu, 2016). The age brackets of the students are divided into six categories (<21, =21, =22, =23, =24 and >24 years of age) not less than a third of the maximum student number should exist for any age bracket. Students with ages below 25 are typically found in DP3, as the National Diploma requires students to have completed their secondary education. Academic achievement is related to the final grades obtained by students (A. J. Swart, 2016) and is primarily considered in this study when students attain a

final grade of 50% or more. The pass rate is calculated by dividing the number of students obtaining 50% or more by the total number of registered students per gender, age bracket and home language.

5. Results and discussions

Table 1 indicates the 14 home languages of the female students along with their respective pass rates per age bracket (percentage shown on the right hand side under ‘Success’). Five languages, highlighted in light grey, form the major portion of the results, as their values constitute the greater number of students (at least 20 female students and 60 male students required). Table 2 presents the results of the number of male students per home language along with their respective pass rates.

Table 1. Home languages of female students with their respective pass rates per age bracket

Languages / Ages	<21	=21	=22	=23	=24	>24	Total	Passing	Success
Afrikaans	86%	64%	100%	50%	100%	67%	32	24	75%
English	100%	67%	NA	100%	NA	40%	10	6	60%
IsiZulu	67%	55%	50%	67%	100%	50%	30	19	63%
Ndebele	50%	NA	NA	NA	NA	NA	2	1	50%
Other African	NA	50%	100%	NA	100%	NA	4	3	75%
Other European	NA	NA	NA	NA	0%	0%	2	0	0%
Sepedi	100%	50%	67%	50%	100%	100%	19	15	79%
Sesotho	75%	69%	62%	62%	57%	57%	396	252	64%
Seswati	100%	NA	NA	NA	100%	NA	2	2	100%
Setsonga	100%	100%	NA	NA	NA	100%	5	5	100%
Setswana	60%	63%	65%	50%	59%	64%	234	142	61%
Venda	67%	0%	33%	0%	33%	56%	24	10	42%
Unknown	NA	NA	NA	NA	NA	NA	0	0	NA
Xhosa	71%	65%	71%	46%	67%	68%	95	62	65%
Total number	147	175	149	123	71	190	855		855
Total passing	106	112	96	69	44	114		541	541
Pass percentage	72%	64%	64%	56%	62%	60%			63%
Fluctuations	NA	8%	0%	8%	-6%	2%			2%

Table 2. Home languages of male students with their respective pass rates per age bracket

Languages / Ages	<21	=21	=22	=23	=24	>24	Total	Passing	Success
Afrikaans	88%	77%	80%	58%	63%	52%	559	406	73%
English	72%	80%	75%	91%	71%	48%	89	63	71%
IsiZulu	91%	56%	67%	87%	45%	73%	69	49	71%
Ndebele	NA	100%	100%	NA	NA	100%	5	5	100%
Other African	100%	100%	100%	100%	NA	60%	16	12	75%
Other European	NA	100%	0%	100%	NA	100%	4	3	75%
Sepedi	83%	57%	43%	63%	57%	100%	43	29	67%
Sesotho	67%	63%	60%	68%	59%	67%	1259	810	64%
Seswati	100%	100%	100%	NA	NA	100%	7	7	100%
Setsonga	80%	71%	50%	100%	50%	63%	30	20	67%
Setswana	73%	67%	60%	53%	67%	57%	498	307	62%
Venda	100%	100%	100%	100%	100%	NA	13	13	100%
Unknown	100%	NA	50%	0%	50%	67%	9	5	56%
Xhosa	56%	82%	53%	79%	56%	54%	244	155	64%
Total number	373	567	504	431	324	646	2845		2845
Total passing	276	397	330	287	196	398		1884	1884
Pass percentage	74%	70%	65%	67%	60%	62%			66%
Fluctuations	NA	4%	5%	-1%	6%	-1%			2%

The number of male students outweigh those of the female students by more than 3:1 (2845 male students from Table 2 versus 855 female students from Table 1). A possible reason for this may be related to stereotyping, where the cognitive behaviour of women are influenced by what society in general promotes (Cadaret, Hartung, Subich, & Weigold, 2016). However, a very similar ratio exists with regard to the home languages of both genders, with the notable exception of Afrikaans (559 males to 32 females representing a ratio of more than 17:1). It is noteworthy that both females and males have a very similar pass rate percentage (63% from Table 1 compared to 66% from Table 2).

The 24 years' age bracket students are the largest cohort with 190 females from Table 1 and 646 males from Table 2. However, if the majority started their National Diploma at 19 years of age (having obtained their National Senior Certificate at 18 years of age), then they would normally register for DP3 at 21 years of age, as DP3 is normally offered in the fourth semester of study. This indicates that students are taking too long to complete their qualification within the allotted time (3 years for a National Diploma in SA). This is contributing to the poor success rate (around 20%) currently experienced in SA, according to The Council on Higher Education (2013). This impacts negatively on the funding received by institutions from the government of SA. It is further noteworthy that the highest pass rate percentage (72% for females and 64% for males) occurs for students in the age bracket of 21 years or less (bottom entry). This correlates with results of Richardson and

Woodley (2003) who stated that in the UK older students tend to perform poorer than younger students at older universities.

All of the official 11 languages used in SA were found in the data (Afrikaans, English, Sepedi, Sesotho, Seswati, Tsonga, Tswana, Venda, Xhosa and Zulu) (A.J. Swart & Kuriakose, 2014). Three additional results, as selected by students when they registered for the module DP3, were also found, namely “Other African” (such as Shona or Chichewa), “Other European” (such as French or Portuguese) and “Unknown” (those not wanting to disclose any information). The languages with the overall best pass (success) rates are Afrikaans (75% and 73%) and Xhosa (65% and 64%), while the lowest language pass rate occurs for Setswana (61% for females and 62% for males) (considering only languages with female numbers above 20 and male numbers above 60). This correlates well with the results from Swart and Kuriakose (2014) who found that Xhosa speaking students had one of the lowest failure rates in a module relating to work integrated learning.

The bottom entry (Fluctuations) in Table 1 and Table 2 gives the difference between pass rates for each successive age bracket. It seems to suggest that males and females are out of sync with regard to the observed fluctuations (when male pass rates increase, female pass rates decrease), except for the first fluctuation between those younger than 21 and exactly 21 years of age (4% lower for males and 8% lower for females).

6. Conclusions

The aim of this paper was to analyse the relationship between student demographics and the academic achievement of undergraduate engineering students in a design based module. This was done for a 15-year period from 1998 to 2013 where the gender, age and language was analysed with regard to the academic achievement of the undergraduate students. The results revealed that males outnumber females by more than 3:1. However, they both enjoy a relatively modest academic pass rate of 63% and 66% respectively, suggesting that both genders perform equally well in the design based module. The results further showed that younger students, less than 21 years of age, have a higher pass rate than older students who are more than 24 years of age. Finally, students with an Afrikaans or IsiZulu mother tongue have a higher academic pass rate than compared to students with a Sesotho, Setswana or Xhosa mother tongue. A key recommendation is to provide additional academic support to older students who may be struggling to synthesize knowledge and skills from a wide number of modules. Furthermore, additional academic support should be provided to students with a Sesotho, Setswana or Xhosa mother tongue who may be struggling to understand the English language in terms of what is really expected from them in the design based module. This challenge may be alleviated through the inclusion of numerous artworks that are familiar to these students, and which may better help to explain the

intended learning outcomes of the module. These interventions may help to better shape future engineering students, so that their engineering practice may not be miles apart, but similar to widely accepted standards that may contribute to the socio-economic development of communities, industries and countries.

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LearnTeamPlenum – A Pragmatic Approach for Inverted Teaching

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Abstract

The paper proposes a new teaching approach, that combines ideas from just-in-time-teaching (JiTT) and the inverted classroom (IC). It has been adapted from the LearnTeamCoaching. In comparison with other inverted teaching scenarios, it requires less preparation effort on the instructor side, i.e. no videos and no intensive just-in-time preparation. The students are asked to investigate the subject autonomously using provided papers and the Internet. In the common lecture – the plenum - the reflection of the learning matter is based on student's questions and posters that have been prepared as a result of the investigation. The plenum is moderated by the students. The paper introduces the method and provides details regarding the experience gained during its fourfold application at the HTW Berlin in the study program computer science and business administration. In the end, the application of the method for different subjects and different organizational settings is discussed.

Keywords: *inverted classroom, just-in-time-teaching, teaching experience, competency-based learning*

1. Introduction

Just-in-Time Teaching (JiT) and Inverted Classroom (IC) are activating teaching methods that are very popular in today's university education systems. It is widely agreed that the activation of students enables the development of skills that are conducive to professional success. The idea of IC (e.g. Lage et al. 2000, Bergmann and Sams 2008) and JiT (e.g. Novak et al. 1999, Henderson and Rosenthal, 2006) is, that the students prepare the content before the actual lesson at home (in IC with videos, in JiT with provided readings) and the common classroom time is actively used to discuss and apply the learning matter. The classical lecture-example-homework cycle is left in order to earn a more learner-centered classroom. The students are able to work through the provided material on an individual basis, adapted to their own learning style and speed. They are asked to answer related questions and submit questions that arose when studying the provided material. In JiT the results enable the instructor to prepare the lesson (just-in-time) according to the students needs. The common classroom time (mostly conducted by the instructor) is then used to deepen the understanding and to discuss and answer the open questions.

In this paper we introduce a teaching method that takes advantages from the IC repertoire as well as JiT. The introduced method is called LearnTeamPlenum (LTP). It variegates the JiT process as it leaves even more responsibility to the students, which also have to moderate the clearing process in the common lecture. The design of the common lecture is inspired by the IC method as described in (Spannagel & Spannagel, 2013).

The LTP method is a continued development of the LearnTeamCoaching (LTC) – an approach introduced by (Fleischmann et. al. 2003). We will first sketch the learning process in the original LTC approach and then describe adaptations that have been made to keep the effort on the instructor side manageable for one person.

LTC is structured into three phases: learn, team, and coaching.

1. **Learning:** The students work autonomously. They use a provided script to acquire the learning matter and are asked to apply their knowledge in small tasks. During the learning process the students are asked to reflect their knowledge by answering attendant questions and solve small tasks. Problems should be made explicit by formulating suitable questions.
2. **Team:** In the second phase, the students meet in their team, mutually propose their solutions and discuss the open questions. Questions that can't be answered in the team are collected in a common question pool.
3. **Coaching:** In the last phase, every team meets the instructor. The meeting always follows a given agenda and covers the assessment of learning success, the answering of open questions and a feedback reflecting the method. The agenda of the coaching session is described in Figure: 1.

It is important to note, that the responsibility for the coaching session is shared between the instructor and the team. The students take in turn different activities like the moderation, the time management, the question pool tracking and the protocol. This way the students take an active role in the learning process and also acquire further competencies.

<p>learn diagnosis & contact</p> <ul style="list-style-type: none"> • question pool • visualization • agenda • prioritization • time plan <p>5-7 minutes</p>	<p>main phase</p> <ul style="list-style-type: none"> • moderation • support team in the problem solving process • provide trustful atmosphere for questions • provide expert knowledge (only on demand) <p>ca. 75 minutes</p>	<p>conclusion and retrospective</p> <ul style="list-style-type: none"> • compile conclusion • record open questions • analysis of problems (team process) <p>10-15 minutes</p>
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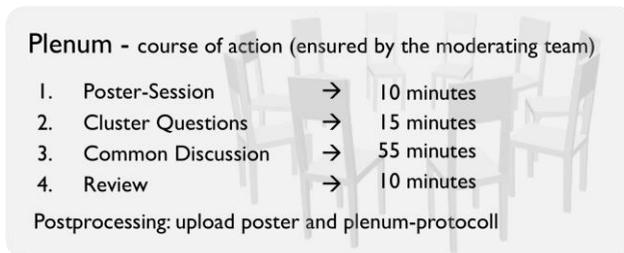
Figure: 1 Agenda of the LTC- coaching session

The method is very flexible and can be used in various different settings. (Fleischmann et. al. 2003) describes its application in an industrial engineering lecture. Here the normal alternation of lecture and tutorial was completely replaced by the LTC-process. The lessons were distributed as follows: phase1 (learning) was given as homework. For the second phase (team) 2 x 90 minutes with time and (individual) team room were provided. For the third phase (coaching) again a 90-minute unit was spent. This means that the whole content of the course was put across via the LTC method. The assessment was done using a normal written examination. The authors described the use of the method as very successful. „The students have been able to acquire most of the content either on their own or in the team - [...]. They admitted to learn more sustainable and to reach the same progress in a smaller amount of time.” The method acknowledges the different skill levels and different learning types and forces the acquiring of knowledge on different competence levels. The students not only listen to the lecturer but also have to acquire the content themselves and present and explain it to each other. In the coaching session further competencies as presentation and moderation skills are practiced. The major critic from student side was the time effort. To neutralize the used time the authors recommend to shorten the content where applicable. For the lecturer the application of the LTC-method enforces more presence. Instead of the three lessons per week, they have to organize and perform one coaching session per team. Further effort arises with the preparation of the material. In the described setting the scripts and tasks have been explicitly created in order to cover exactly the corresponding learning matter.

2. Adaption of the method: LearnTeamPlenum

Inspired by the idea to increase the involvement of the students (Mason et al. 2013, Chi et al. 1994, Gannod et al. 2008) the author decided to adapt the LTC method, as it did not require to have videos in place. Still the method was appraised to be very time-consuming for one lecturer. Therefore it was looked for an adaption, such that the method could be transferred to a normal lecture format (90 minutes lecture + 90 minutes tutorial). In fact, all three phases are used, but the coaching is not performed with single teams, but with the whole course (max 40 students). According to inverted classroom terminology, c.f. (Spannagel and Spannagel, 2013), the new format is called plenum. The 3 phases are modified as follows:

1. **Learning:** Instead of a prepared script the students get the task to investigate a certain topic. Relevant literature or helpful links are provided. In addition questions and exercises are given, that have to be answered / solved in order to internalize the learning matter. Problems should be made explicit by formulating suitable questions.
2. **Team:** In the second phase, the students meet in their team, present each other the solutions and discuss their approaches and problems. Questions that cannot be solved are gathered in a common question pool. Additionally to the primary setting, the students are asked to visualize the subject on a flipchart poster.
3. **Plenum:** The time of the lecture is used to meet all participants. The moderation of that session is delegated to one of the teams. The event starts with a poster session, where all participants look at the different posters (all covering the same subject). All students are asked to note their questions on moderation cards. The questions either stem from the prepared question pool or denote unclear aspects found on other posters. The moderating team collects the cards. Together with the audience they are clustered and prioritized in front of the class. The main time is now used for answering the questions. All students prepared the subject. So all students are addressed. The instructor only interacts, if needed. The plenum ends with a method review. Every team is asked to reflect the teamwork and to generate ideas to improve the next round. Finally, the part of the moderating team is regarded. The team appraises itself and gets feedback from the audience. The agenda of the plenum is described in Figure: 2



Plenum - course of action (ensured by the moderating team)		
1. Poster-Session	→	10 minutes
2. Cluster Questions	→	15 minutes
3. Common Discussion	→	55 minutes
4. Review	→	10 minutes

Postprocessing: upload poster and plenum-protocoll

Figure: 2 Plenum. Course of actions

2.1. Details of the Application

The LTP method has been applied in the usability course of the BA-program „computer science and business administration“ of the HTW Berlin. In 2016 it has been used for the fourth time, c.f. (Siegeris & Krefting, 2014). The following paragraphs explain the adaption in more detail and contain hints gained within the last four years of application.

Frequency

In order to reduce the time needed, it is recommended to alternate the LTP units with normal lectures: first week poster preparation and plenum, in the next week normal lecture and tutorial. At the HTW Berlin, the group of all six-semester students (mostly between 30-35) had been subdivided into 5-6 teams. Every team had to prepare a poster every second week and to moderate at least one plenum-session.

Assignment task and poster preparation

Applying this method, it is not necessary to provide a video or a script for the preparation. Instead the students are asked to investigate a certain subject on the base of given questions. The investigation can be supported providing relevant resources, etc. web links or scientific papers. Formulating the questions, it is important to check, that the answers require more than a simple enumeration of facts, but force a deeper examination of the subject. In addition it is recommended to pose tasks that require to make a choice for a certain method and to apply it to a typical problem of the field. All the results have to be visualized on the poster. The students are asked to cite their literature and to provide interesting resources/links in a common Moodle directory.

For the poster preparation a whole 90 minutes block is granted. The students get flipchart paper and pencils. The task, to visualize the subject on a given size, requires the students not only to discuss their answers, but also to prioritize the content and to come up with a certain visualization strategy. The time limit for this complex assignment had the side effect, that the student came prepared. This is a well-known challenge in an inverted classroom setting, (Spannangel & Spannangel 2013). Figure: 3 shows two poster examples that visualize the subject accessibility.

Goal of the plenum and role of the instructor

In the plenum all the open questions should be answered. The moderation of that process is left to the students. To support the non-frontal character and the changed responsibilities, the seating arrangements are changed in the beginning in order to form a circle. The instructor is part of the round. She only interacts in case the discussion get stuck or to correct faulty assumptions. Still, from the perspective of the instructor, the plenum should be also an instrument to guarantee that all important facts and methods had been

communicated. Therefore the instructor should use the time of the poster presentation to note her own questions (asking for important or missing facts) on moderation cards and to join them into the set of question to be tackled during the discussion.



Figure: 3 Poster examples for subject accessibility

Assessment of the course

For the assessment of the course a normal written examination was used. The topics of the examination stemmed to the same extend from the LTP lessons and the normal lectures. The poster and the moderation had to be fulfilled in order to reach the admission for the examination. The weekly change of normal lecture and LTP required precise planning and coordination. Figure: 4 shows a mind map that has been used to support the communication with the students.

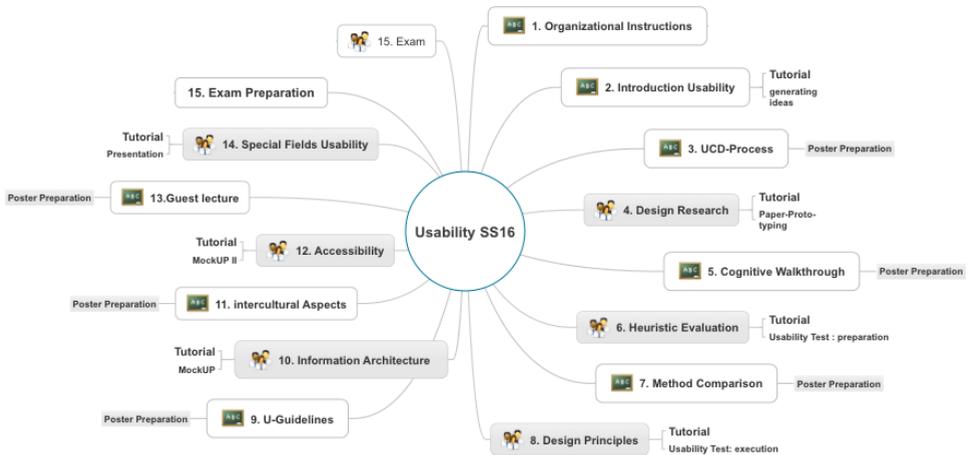


Figure: 4 Alternation of normal lectures (white) and LTP units (grey)

2.2 Evaluation

The whole course has been evaluated as very interesting and alive. The following student comments are representative samples: „very interesting and diversified didactical method.” „The atmosphere during the discussion was pleasant and made it comfortable to join.“, „I liked the interaction, that stimulated to actively participate.“ The main critic concerned the preparation effort, which was mentioned to be more time-consuming than in a normal course. Only at the exam preparation the effort could be recouped, because the LTP-topics were already internalized and had not to be learned again. Some minor concerns related to the coordination of the different lessons, which sometimes led to confusion about the current procedure.

3. Discussion and Summary

The LTP method was applied at a university of applied science in a computer science program. The student numbers are forty at maximum. A number of 30-35 students seem to be ideal. This results in a team size of 5-6 students and 6 LTP-cycles. Every team has to prepare six posters across the semester and to moderate one plenum. With more teams, respectively more posters, the effort would again increase. A weekly alternation of normal lectures (and normal tutorials) and LTP-cycles would be not possible as more time for the poster preparation would be needed. With more participants, also the plenum must be adapted, as a discussion in a circle would come to its limits. With the weekly change of the teaching mode, the instructor gets the possibility to decide which subject are suitable for self-study and which need explanation. Through this flexibility the method seems to be suited even for well-established lectures. Still the use in courses with changing content is suggested. Here it helps to reduce the effort and still guarantee up-to-date content.

The conversion of a lecture into the new format is less expensive than the application of other inverted techniques. In contrary to the LTC-method, the presence time is similar to that of a classical lecture. It furthermore needs no pre-phase as in typical IC-scenarios, where a video has to be produced beforehand. The experience shows that a similar scope as in a normal lecture could be covered.

Generally it can be said, that the format is very refreshing. The students bring new aspects and up-to-date content. The event is alive and the annual repetition does not get boring. A further advantage is the bigger appreciation of the students. They can focus on their demands and do not have to spent times on known content. In the plenum discussion they have the chance to show their expert knowledge. This can be very enriching for the whole group, especially if practical experience is presented. The main reorientation for the author was the change of the role, from presenting lecturer towards participant. It was unfamiliar to remain reticent and to trust onto the discussion. Still, it is a win-win situation.

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Universities and standardization instruments: the willingness to put an end to the organized anarchy

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Abstract

Many sociologists have for a long time based their research on the work published in the 1970s, in which universities were regarded as organisations that operate in a particular way. They were approximated to “organised anarchies” or to “loosely coupled systems which were considered host to “unclear technologies. This article call into question these concepts and confront them with the evolution of the piloting way of contemporary establishments of European higher education. The empirical material for this paper comes from the analysis of texts and reforms initiated in European universities. The paper will show the effects of standardization instruments on academic profession and how these instruments (and notably the learning outcomes approach) transform each segment of the university and generate a deep interdependence between all of them.

Keywords: *Standardization instruments; organized anarchy; universities; academic profession*

1. Introduction

Many sociologists have for a long time based their research on the work published in the 1970s, in which universities were regarded as organisations that operate in a particular way. They were approximated to “organised anarchies” (Cohen *et al.*, 1972) or to “loosely coupled systems” (Weick, 1976 ; Orton & Weick, 1990) which were considered host to “unclear technologies” (Cohen & March, 1974). This article call into question these concepts and confront them with the evolution of the piloting way of contemporary establishments of higher education.

The empirical material for this paper comes from the analysis of texts (published between 1998 and 2016 by the European Commission, the OECD and the members of the piloting group of the Bologna Process) and reforms initiated in European universities (especially since 1998 with the progressive introduction of the quality assurance mechanisms and the learning outcomes approach in Belgium, Denmark, France and United Kingdom). The paper is divided in three parts. The first concern the different instruments (such as ECTS and diploma supplement) developed by international organisations and their integration in an apparatus (in Foucault’s sense) of standardization of higher education. The second analyses the effects of these instruments and of the apparatus on academic profession and inscribes the article in the whole of works (see for example Derouet and Normand, 2012; Evans and Nixon, 2015; Lucas, 2014; Normand, 2015) examining the nature and extent of the changes experienced by the academic in their teaching profession in recent years. The third studies how these instruments (and notably the learning outcomes approach) transform each segment of the university and generate a deep interdependence between all of them.

2. Inter-connected instruments in European higher education

Since fifteen years, some “public policy instruments” (in the sense of Lascoumes and Le Galès) were installed in higher education in the following of the Bologna Process. We can note the European Credit Transfer System (ECTS), the Diploma supplement, the quality assurance mechanisms, the *learning outcomes*. These instruments aims to constraint the responsible of the countries members of the Bologna Process to reform their system by integrating the Bologna prescriptions. They are integrated in an “apparatus (in Foucault’s sense) of higher education normalization” (see Croché, 2010). The power of the apparatus is due to the fact that prescriptive messages are sent to all the facets of the organization and of management of the higher education establishments.

Listing the entire range of instruments set up to standardize (in general the goal of standardization is to enforce a level of consistency or uniformity to certain practices or operations within the selected environment) higher education in all facets of its functioning would serve little useful purpose. We are interested here only in those instruments related to the organization and the practice of higher education. One of the common characteristics of

such instruments is that they were presented as trivial, a fact that contributed to hide their potential for change. The majority of them did indeed involve reforms which could be regarded as strictly cosmetic (Croché & Charlier, 2009). Let us take two examples. The passage on the architecture of studies according to the “3-5-8” model frequently failed to produce any change as regards the exercise of the academic work. In many establishments, the conversion to the ECTS system did not have any effect on academic practices and it was mainly mechanical. A certain number of lecture courses was transformed into an ECTS equivalent. However, conceiving and organizing teaching in the manner considered by ECTS would necessitate a major transformation of practices. It would imply a strong reduction in the activities dedicated to the transfer of knowledge. In this case, as in the case of the “3-5-8” framework (model of studies), observing that the requirements related to the ECTS are often bypassed leads us to the conclusion that the instruments’ potential for change is negated. The potential for change of these various instruments can appear only if favorable circumstances allow it, and if actors, therefore, choose to activate them.

3. The apparatus reaches the heart of the teaching profession

Among all the standardisation instruments of higher education, learning outcomes undoubtedly have the highest potential for transformation of the university teaching profession, notably because they imply to predict the future and then reduce the uncertainty and the risks. Here, we will analyse only the standardization implied in teaching by the learning outcomes, not forgetting that the standardization is taking place in many different dimensions of modern higher education including research performance and management process.

The definition of learning outcomes is given for the first time in the European prescriptive texts, in particular, in the ECTS Users' Guide 2004. The learning outcomes are, thus, defined as:

“statements of what a learner is expected to know, understand and/or be able to demonstrate after a completion of a process of learning” (European Commission, 2004: 44).

In 2015, the European Commission defined the learning outcomes as

“statements of what the individual knows, understands and is able to do on completion of a learning process” (European Commission, 2015: 72).

This explicit presentation of the results that the learner can expect at the end of his or her personal learning pathway is common in countries where the financing of studies is either totally or partially provided by the students. However, defining learning outcomes goes against all traditions in countries where this financing is provided by the community. Today, in countries where the volume of public funding of education depends directly on the market share of each establishment, the learning outcomes model is applied on a

voluntary basis. In 2015, 32 European countries members of the Bologna process steering and encouraging the use of learning outcomes in curriculum development, while 14 encourage learning outcomes through guidelines or recommendations. The importance of learning outcomes in programme development has grown (European Commission/EACEA/Eurydice (2015: 71).

Souto Lopez (2015) presents a history on the introduction of learning outcomes to the piloting system of the European higher education area's establishments and notably in Belgium. He shows three expected effects of the learning outcomes: at the international level, they could support the recognition of qualifications; at the national level, they were useful within the framework of the quality assurance mechanisms; at the local level, they made it possible to identify the best adapted teaching practices and methods. It goes without saying that this identification of the "good practices" goes hand in hand with measures intended to both support such practices and to discourage less effective practices.

The document *Guide for Busy Academics. Using Learning Outcomes to Design a Course and Assess Learning* is a good illustration of the new method. It explains more precisely "the learning that teachers are seeking to promote" at the University of Bristol in United Kingdom (see University of Bristol, s.d.). The curriculum and its "intended learning outcomes", the teaching methods used, the resources to support learning, and the assessment tasks and criteria for evaluating learning – need to be "aligned" to each other and facilitate the achievement of the intended learning outcomes. The document underlines the main steps in the alignment process:

- "1) Defining the intended learning outcomes (which determine the teaching and curriculum objectives – the steps we take to achieve the learning outcomes.)
- 2) Choosing teaching/learning activities likely to lead to, help and encourage students to attain these intended learning outcomes.
- 3) Engaging students in these learning activities through the teaching process.
- 4) Assessing what students have learnt using methods that enable students to demonstrate the intended learning and, in the case of formative assessment, giving feedback to help students improve their learning.
- 5) Evaluating/judging how well students match learning intentions: a process that is guided through explicit and manageable criteria.
- 6) Awarding marks/grades in line with these judgements".

The potential for the influence of learning outcomes on professors' practices will be achieved only if standardised measurements are carried out on a scale sufficient to facilitate reliable comparisons. The project "Assessing Higher Education Learning Outcomes"

(AHELO) of the OECD was launched at this end in 2010. This project was an answer to a request addressed by the Ministers of Education from the OECD countries at a meeting in Athens in 2006. In January 2008, assembled at an informal meeting in Tokyo, the Ministers specified their request and encouraged the OECD to set up one “PISA for the superior” (OECD, 2008). A feasibility study, focused on the studies of economics and civil engineering, was completed in 2012 in 17 countries. The next objective is to carry out tests in other sectors in all the OECD countries after 2016 (OECD, 2014). The *modus operandi* here is very similar here to that used in the PISA investigation or to the open method of coordination. Data are made public and accessible by national decision makers. They allow for a swift comparison of the performance of various systems, which encourages the persons in charge of the least efficient systems to adopt measures to improve their output. If it is still too early to affirm that the AHELO project will achieve a dynamic of this kind, based on the observation of the effects produced by PISA, one may assume this will occur.

4. The willingness to put an end to the organised anarchy by means of instruments

After this brief examination of some standardisation instruments of higher education, let us return to the theories presented in the introduction. According to these theories, universities are seen as “organised anarchies” (in general, these terms suggests that organizations tend to formulate objectives in responses to their activities rather than in advance, that organizational members do not fully comprehend the workings of the organization, and that their involvement in organizational activities is fluid and unpredictable) or “loosely coupled systems”, in which one can find “unclear technologies”. The efforts both of the European Commission and the OECD seem to aim at correcting the characteristics of the university that these concepts underline. For Friedberg and Musselin (1989), an organised anarchy is the product of rational strategies used by professors to avoid any quantitative evaluation of the research and teaching activities at the university. Thus, anarchy is only presumed and it does not concern all aspects of university work. The question of the coexistence of both supposed organisational anarchy and the rationality of scientific work can be answered by Thompson (1967). He shows that organisations search at the same time for rationality and indetermination: the technical core constitutes a closed system, where uncertainty is excluded, whereas the institutional level maintains openness, thus giving the appearance of anarchy. The concept of “loosely coupled system” makes it possible to explain this double nature. Both rationality and indetermination are necessary for the effective performance of the organisation – here the university. The only possible manner in which to preserve rationality and indetermination at the same time is by locating them at different places and by preventing cross-contamination.

The research carried out, which is summed up in the underlined statements above, mentioned that the organisation is not homogeneous and the actors involved seek to

preserve the heterogeneity of the segments that constitute it. The decoupling dimension is also addressed by Meyer and Rowan (1977: 58). They consider that educational establishments must try to reconcile incompatibilities between institutional and technical pressures. They do this by decoupling the formal structures from activities in order to maintain the “ceremonial conformity”. Decoupling is “a logot between the organisational structures which reinforce legitimacy and the organisational practices which are regarded by the organisation as being most efficient”.

In the universities, the rationality core is easy to identify and is designed around research and administration methods of scientific proof. Meanwhile, the sources of uncertainty are diverse and each one of them is likely to cause or maintain the strategies of segmentation or decoupling. They relate to the political and societal expectations as regards the university, the labour market’s reaction to graduates’ skills, the effectiveness of the used teaching methods, the relevance of the research protocols, etc.

The outcomes-based model in higher education highlights both the learning outcomes and the incentives provided to researchers to focus their work on concrete applications; it seeks to generate each one of these uncertainties by an explicit procedure. The project assumes the distinction between teaching and research activities and also the clarification by control indicators of the effectiveness of both types of activities. With regard to teaching activities, piloting by learning outcomes seeks to provide to decision makers and operators the means for measuring teaching efficiency.

“Measures of learning outcomes also hold important promises for higher education faculties and leaders in providing evidence-based diagnosis tools on the strengths and weaknesses of their courses and programmes to be used as part of their quality improvement efforts.” (Tremblay *et al.*, 2012: 56)

It is not sure that the project’s promises carried through the learning outcomes could be held. The learning outcomes aim to create a consistency between the objectives of teaching, the evaluations, and the teaching methods. In short, it is an instrument that seeks to make the teaching result more predictable and even more programmable (see Legendre, 2012 ; Brancaleone & O’Brien, 2011). It does this by proposing a specific managing system of uncertainty that defines the manner in which the learner will react to the stimuli which are presented to him. On the one hand, the instrument – here the learning outcomes – is underlined by the recognition of what is obvious. The obvious, in this case, is the fact that it is up to each student to develop his competences. On the other hand, it provides means for measuring the effectiveness of the various methods used to lead the student to the Intended Learning Outcomes (Biggs & Tang, 2007). The unpredictable character of the learner’s reactions ceases, thus, to be a factor of uncertainty. It becomes simply one of the variables that the learning outcomes have the authority to manage.

The learning outcomes can also contribute to disarm the argument of the irreducibility of the teacher's work, put forward, in particular, by authors denouncing "academic capitalism". "Learning, and research require reflection, engagement, collaboration, trial-and-error, processing, practice; all of which take time" (Walker, 2009: 68). Higher education ceases to be one of those "professions with prudential practice", defined by Champy (2009) as professions where it is impossible to precisely envisage the result of the actions initiated. In this case, the choice of whom does not imply the application of an unquestionable scientific framework. The choice results then from the professional's conviction, and from his approval of the risk, which is a risk in respect of which he may be held to account.

All the instruments (ECTS, quality assurance mechanisms, learning outcomes, etc.), which concern the academic profession, have implications for university management in Europe and conduct to think the academic profession and the university management as a couple of issue. They were created in order to divest the universities of the characteristics that led some analysts to approximate such establishments to organised anarchies, with weak interdependence, using unclear technologies. Such instruments lead to extreme specialisation of tasks, which, thereby, triggers changes in collegial management. Management is entrusted to managers who may be strangers to the university world. The organisation of education is delegated to technicians of applied pedagogy, who may come from private offices of engineering as it is the case notably in Denmark and in other Nordic countries (see Kalpazidou-Schmidt & Langberg, 2007). Research is entrusted to specialised researchers, assisted by professionals in the drafting of file requests for funding. Teaching becomes the responsibility of professors specialised in pedagogic animation, surrounded by technicians who guide them (as it is more and more the case in Belgium since the adoption of the learning outcomes approach (see Souto Lopez, 2015)). In this way, each segment of the organisation utilises those technologies considered to be the most efficient by the professionals of that particular segment. Each one is, thus, controlled in the most rational way. The question of interdependence then arises in renewed terms: the specialisation of tasks and techniques reduces the interferences between the segments, but generates a deep interdependence between all the segments and activities conducted within the same segment.

In Europe, few countries are engaged in the specialization of the four spheres presented above. Examples of commitments to carry out radical reforms in one or the other spheres are easy to find. The countries undergoing these reforms are then presented by the pilots of the Bologna Process as examples of good practices which must inspire all the others, in Europe but also in other World regions and especially in Africa (Charlier, Croché & Panait 2016).

If all the instruments presented in this paper have implications in European higher education, they also have (or could have) implications in other World regions which took the European reforms as model. For example, the learning outcomes approach is integrated in the Tuning (*Tuning Educational Structures in Europe*) project which was first launched in Europe and which aims to contribute to the transparency of curricula as well as the development of learning outcomes and quality assurance. This project was used also as a model by countries from South America, Russia, United states and Africa which have adapted it to their own needs (Croché & Charlier, 2012). Then, now, it is impossible to think reforms engaged in Europe without considering their worldwide integration. Instruments such as the creation of the AHELO, a global cross-countries initiatives, help to think Higher Education reforms on a worldwide basis.

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Integration of a MOOC into a traditional third-level e-learning platform

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Abstract

This article presents the didactic concept and the Massive Open Online Course (MOOC) e-learning solution for the course “Environment, computer science and society” in the environmental informatics degree course at the HTW Berlin, which was realised on the basis of the traditional third-level learning platform Moodle.

Keywords: MOOC; integration; e-learning environment.

1. Introduction

The “Environment, computer science and society” course was established as part of the environmental informatics degree at the HTW Berlin. Its aim is to provide a basic knowledge of the subject and to evolve, in particular, an outlook on the social and societal changes caused by information and communications technology (ICT). As well as raising awareness and developing a set of values, the course is designed to be action oriented as well as interdisciplinary. To this end, the didactic concept of the course includes interdisciplinary project work as well as lectures and seminars (see Fuchs-Kittowski & Wohlgemuth (2016)). A further goal is to clarify how computer scientists can contribute to technically, socially, and ethically responsible computer usage through their work in information system design and software development.

Since the founding of the bachelor’s degree course in environmental informatics, Klaus Fuchs-Kittowski has taught “Environment, computer science and society” (see Fuchs-Kittowski (2013)). In order to preserve the special expertise and experience of this outstanding representative of the subject “computer science and society” and make it available to future generations of students as well as other interested parties, it was decided to digitally record the lectures and make them available as part of an e-learning environment. Within the framework of an in-house project of the HTW Berlin, e-learning support for this course was designed and implemented as a Massive Open Online Course (MOOC). A major challenge of this approach was the question of how to implement a MOOC within a traditional learning platform (Moodle).

This article is structured as follows: the goals and didactic concept of the course “Environment, computer science and society” in the environmental informatics degree at the HTW Berlin are described in Section 2. The objectives and requirements of the e-learning solution are presented in Section 3 and the MOOC concept for this course is discussed in Section 4. Section 5 presents the technical implementation of the MOOC within the traditional learning environment Moodle. A summary and conclusion is provided in Section 6.

2. Didactic concept

The course “Environment, computer science and society” aims, on the one hand, to provide a **basic knowledge** of the subject and thereby develop an **outlook** on the social and societal impact of ICT. On the other hand, it should also be **action oriented** and **interdisciplinary** so that future computer scientists can learn to take social and ethical aspects into account when working on system design and software development. In order to achieve this, the didactic concept includes interdisciplinary group project work (project component) in addition to seminar-like classes (lecture and seminar component).

The **basic knowledge** is taught through lectures on different topics. From the multitude of possible topics, those that introduce the themes of the environment, computer science, and society and are related to the subject of environmental informatics were chosen. In this way, a true foundation in the subject is achieved through appropriate fundamental knowledge.

The primary objective of the course is the formation of an **outlook** on the social and societal changes caused by the design and usage of ICT. This goal is achieved through numerous discussions during the lectures (seminar-like classes). The students are also encouraged to discuss information and experiences with their peers through group work and student presentations. This cultivates the collective opinion-forming process and improves the students’ discourse skills.

The core feature of the project work is that students work independently on proposed themes within different project groups. The project structure is intended to facilitate problem-oriented work as well as research-based (see Huber (2009)) and experience-based (see Kolb (1975)) learning. The integrated, didactic project format also stimulates both individual and collective **action**. Positive experiences and outcomes help to build the students’ faith in their own abilities and impact (power) and give them the confidence to continue on-going projects as well as start their own new projects and campaigns.

The **interdisciplinary** nature of environmental informatics is both a strength and a challenge. Students of environmental informatics must learn to design and implement computer systems in environmental fields within interdisciplinary collaborations. This certainly cannot be achieved in a single course. However, “Environment, computer science and society” is an essential building block in the process. As part of the course, project tasks, including an interdisciplinary questionnaire, are tackled by a group of several students. Additionally, one or more external experts from other disciplines are available to support and supervise the students in order to promote interdisciplinary cooperation.

3. Requirements

The main goal of this work was to digitally preserve the course lectures in an e-learning environment and make them accessible to a wide audience as a web-based study opportunity without the need for physical presence. The MOOC is currently a widely-discussed concept (see BIS (2013)) and has proved to be an important and useful addition to teaching methods at universities (see Klobas et al. (2015)). It can be especially helpful for teaching standard knowledge (see EFI (2015), p.15) and can also help to alleviate the lack of qualified teachers. Therefore, it was decided that the e-learning environment for this course should be realised as a **MOOC**.

In this case, the **xMOOC concept** (see Rodriguez (2012)) was used for the lecture component, as traditional lecturing methods (weekly lectures with slides and additional reading material) should be reflected by the system. The cMOOC (see Grünewald et al. (2013)) variant was more appropriate for the project component due to its more open, participatory approach. The students should have the chance to “attend” the lectures through video recordings and integrated presentation slides as well as find additional information and materials on the subject, e.g., books. They should also have the possibility to check their own knowledge through self-tests.

The HTW Berlin uses the world’s most popular open source **learning management system** “**Moodle**” as its primary learning platform. Therefore, the e-learning environment for “Environment, computer science and society” should be implemented on this technical basis. However, Moodle is not designed as a MOOC platform and therefore some functionality must be expanded accordingly, something that would not be necessary if using an established MOOC platform such as iversity.org. The main advantage of using Moodle is that the eLearning Competence Centre provides (free) support for it at the HTW Berlin. This can be used for the development and operation of a customised e-learning environment.

4. Concept

The lecture component begins together with the start of normal teaching (fixed start date). The course then offers a balanced schedule of nine consecutive course weeks (lectures). Each week, multimedia teaching material is provided that covers another chapter of the course “Environment, computer science and society”. To this end, the students (course participants) are offered a series of lecture videos at the start of each week.

The screenshot shows the Moodle interface for the course "Projekt: Umwelt, Informatik und Gesellschaft". At the top left, the Moodle logo is displayed with the text "Die Lernplattform der HTW Berlin". At the top right, the HTW logo is shown with the text "Sie sind angemeldet als Frank Fuchs-Kittowski (Logout)". Below the header, there is a navigation bar with the text "Informatik und Gesellschaft", "Vorlesungen ▾", and "Autor". The main content area features a dark background with the title "Projekt: Umwelt, Informatik und Gesellschaft" and a welcome message: "Willkommen auf den Moodle-Seiten der Lehrveranstaltung 'Projekt: Umwelt, Informatik und Gesellschaft' (U1 B3). Hier gibt es Informationen zur Lehrveranstaltung, Vorlesungsfolien, Übungsmaterialien u.v.m. zentral abgelegt. Auch können hier alle Vorlesungen als Video nochmals angeschaut werden, kleine Tests runden die Videos ab und sollen zu einem erfolgreichen Lernen beitragen." At the bottom of the page, there is a footer with the text "Dokumentation zu dieser Seite" and "Sie sind angemeldet als Frank Fuchs-Kittowski (Logout)". A "Startseite" button is located at the very bottom.

Figure 1. Start page of the e-learning environment for the course „Environment, computer science and society“

These videos were recorded and edited by the “Video production” project at the HTW Berlin. The lecture videos are accompanied by synchronised lecture slides. A progress bar is displayed at the bottom edge of the area containing the lecture video and slides. The bar also serves as a timeline, and clicking on the bar jumps the video to the corresponding location, i.e., forwards or backwards. It is also possible to display the video as well as the slides in full screen mode.

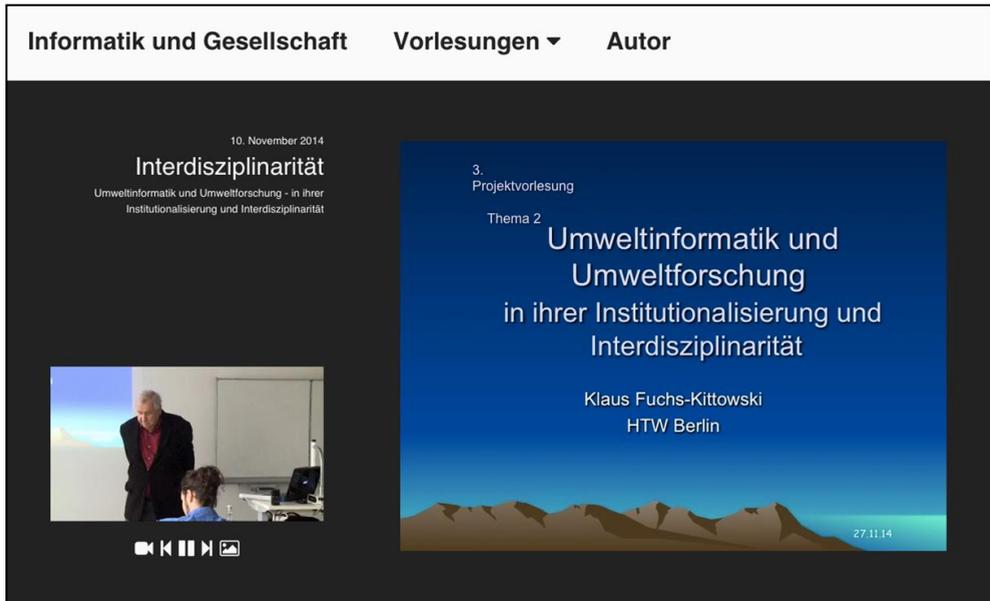


Figure 2. Lecture video with synchronised presentation slides

Additional material, supplementary to the lecture videos, is also provided. This can be in the form of extra information (downloadable content such as lecture slides, lecture notes, or publications by the lecturer, etc.), and book lists (books relevant to the lecture together with a short description and the ISBN), as well as interactive self-tests (see below) that the participants should address in a given week.

The self-tests help the course participants to monitor their learning progress. They can check for themselves if they have retained the most important knowledge from the previous videos. The tests pertain to a particular course week/lecture video, and pose questions on the material presented in that week. The different question types offered by the Moodle platform are used in the tests (e.g., fill-in-the-blank text, multiple choice questions, true/false questions, and matching questions). The students can thus obtain immediate feedback; their answers are automatically evaluated and the results are displayed immediately. The tests can be repeated as often as desired (the questions are permuted in each instance).

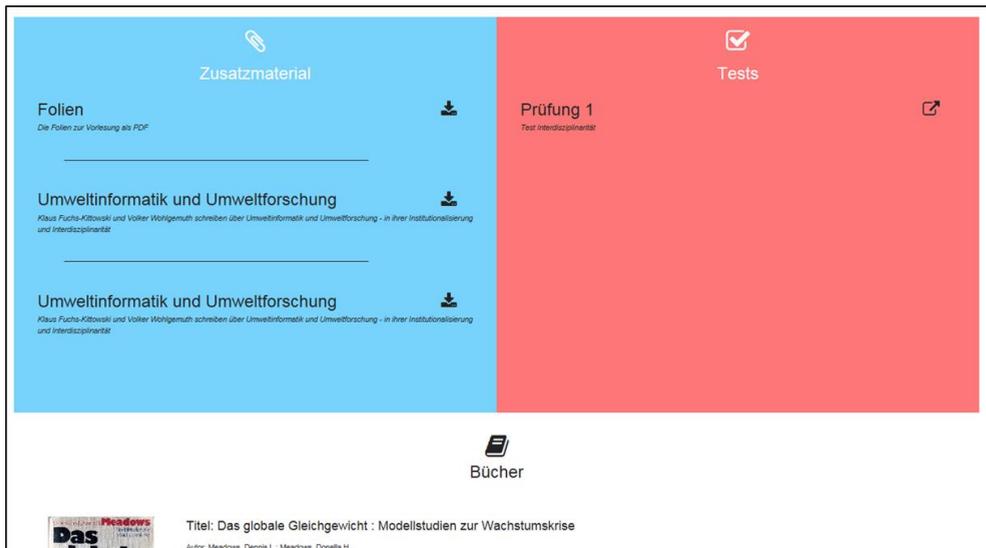


Figure 3. Area for additional material, booklists, and self-tests

A discussion forum is provided for each lecture topic, in which the students can clarify questions with the supervisors, exchange ideas with other students, or discuss further topics. Additionally, the students can find information on the career and expertise of the lecturer.

5. Technical implementation

A special feature of the MOOC used in this case is that it was not implemented in a typical MOOC platform (iVersity, Coursera, etc.), but as an extension of a classic learning platform (Moodle). The implementation was carried out by a project team consisting of five people, who participated in the course in the winter semester of 2014/15 (see Hiller et al. (2015)).

As of version 2.0, Moodle allows the platform to be individually customised, e.g., via HTML, CSS, and JavaScript files. In order to implement the additional features and MOOC-like layout required for this work, several web development frameworks were integrated into Moodle, such as jQuery, Bootstrap, and Font Awesome.

For example, the MOOC-like layout was achieved by overwriting the existing CSS rules provided by Moodle. Among other things, the typical Moodle menu on the right-hand side was converted into a retractable sidebar on the left-hand side, and the area usually available for a Moodle course was significantly increased.

The animated showing and hiding of content when using the menu in the upper area of the MOOC was achieved by changing the CSS properties of the affected elements and including the jQuery library which provides the `animate()` method.

The display and control of the lecture video is achieved using the video tag available since HTML 5. This can be manipulated by JavaScript methods and events, e.g., in order to synchronise the lecture slides with the video playback.

6. Summary and conclusion

The subject of “computer science and society” appears in the curricula of computer science courses (including environmental informatics) in many German third-level institutions (see Kienle & Grunau (2015)). However, there are hardly any university professorships in this subject in the country. Thus, only a few scientists and teachers are trained in this area, and the subject of “computer science and society” is generally taught by part-time teachers instead of full-time professors at many German third-level institutions.

At the HTW Berlin, the subject of “computer science and society” was first established as part of the business informatics course and then introduced into the environmental informatics course by Prof. Klaus Fuchs-Kittowski. In order to preserve the special expertise and experience of this outstanding representative of the subject and make it available for future generations of students, the lecture course was converted into a MOOC within the framework of a traditional third-level e-learning environment.

The MOOC has proven to be a useful tool over the course of two lecture cycles, especially for conveying standard knowledge, and can alleviate the lack of qualified teachers. In general, a MOOC cannot replace personal, individual classes or research-oriented teaching. However, in the case of “computer science and society”, the formation of a set of values is dependent on personalised and contextual discussions of the topic and, for this, certain personalities are irreplaceable.

The implementation of the extension of moodle will be generalised to a moodle plugin. This plugin can be used by other moodle courses to use moodle as a MOOC platform. When finished the plugin will be made available as open source, e.g. via the official moodle plugin repository.

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Learning spaces around the university: Factors that affect the preferences for a space

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Abstract

A building space can play multiple roles within an education institution. New spaces are being designed and created with the hopes of fostering innovation, collaboration and creativity. The idea of developing such spaces can only be realised if there are sufficient resources but the fact is that many institutions simply will not have the resources to create such a change. Given that most universities have existing resources that were developed over the years, we propose a preliminary framework that can be used to evaluate existing learning spaces. The paper reports findings from a survey conducted with 2,842 students in a Singaporean university.

Keywords: *learning spaces, evaluation, informal space*

1. Introduction

Education institutions are places where a community of scholars pursue knowledge, learning, and growth. The architecture of the institution expresses the institution's purpose, presence and domain in a physical form (Dober, 1996). However, Temple (2008) noted that the development of university spaces, new or old, does not include clues on how the learning spaces were conceived which makes the evaluation of learning spaces a challenge. Often, the pedagogical intent is not explicit in the mind of the designer, nor such evidence was easily available. Unless they are specially designed learning spaces (Painter et al., 2012) these spaces are rarely built with learning theories in mind. It is usually an afterthought for administrators and designers to consider evaluating the space although such evaluations are important to understanding how learning space are being utilised.

Like many other campuses around the world, the informal learning spaces evolved over time based on the needs of the users. Boys (2011) argues that one of there is an inherent tension between academics and estate planners, as space is becoming precious. Given that such upgrade requires a substantial amount of investment, there needs to be a clearer understanding of the factors that are important within the space. This paper is part of a larger study that aims to understand the factors that affect students' satisfaction of a learning space.

2. Literature Review

The evaluation of learning spaces is not just merely to measure how effectively the space is being used since the learning place can be described in terms of their social, cultural and architectural entity (Edwards, 2013). For example, utilising data based footfall and survey to establish demand and satisfaction would not paint a complete picture of how the space is being utilised as it fails to consider that learning is an activity (Bligh & Pearshouse, 2011). In order to make a more convincing argument for the existence of a learning space, evaluations need to be grounded in theories of learning.

From a learner-centered perspective, learning can occur at any time through collaboration and socialisation. There is a small but growing interest in the field trying to understand how the physical environment affects teaching and the learning process. Studies in learning spaces can generally be categorised from the field of psychology and the field of architecture with many studies attempting to harmonise the fields through an interdisciplinary approach. From the field of psychology, researchers are interested in how people perceive the space and how learning occurs within the space while researchers from the field of architecture focused on how the facilities and infrastructure support learning.

2.1 Learning Theory

Learning theory refers to the conceptual framework of understanding how knowledge is absorbed. Learning is no longer focused instructionism (Papert, 1993) where the goal was to get knowledge and procedures "transmitted" to students but rather shifting towards a constructivist approach where learning is a result of meaning making from the interaction with others. This means that learning is an active process and knowledge is created based on the social negotiation between the learners and their environment. The learning space, therefore, needs to provide the environment that will challenge the learner and their thinking.

Dugdale (2009) proposed the "learning landscape" as a holistic approach to understanding how a diverse landscape of learning (e.g., formal vs. informal, specialised vs. multipurpose, physical vs. virtual) setting affects student learning. There is a growing shift in examining learning spaces through a learner-centered approach where students, faculty, staff and the wider community can interact to promote a learning discourse. Learning is not just influenced by social factors but is, in fact, a social phenomenon (Rogoff, 1990). A learning space acts as a binding agent that provides the learner with the affordances to help with their meaning making process during the knowledge construction process.

2.2 Architecture

Architecture refers to the physical aspects of the learning space that is visible. This includes the physical building, design, furnishing and facilities within the space. The form and function of these spaces remain virtually unchanged within university campuses especially in formal learning spaces such as lecture theatres and classrooms. Such spaces are traditional and teacher-centered. This model functions well as students are not expected to be highly interactive during lectures nor are they expected to be doing so (Jamieson, 2003).

As we adopt a more student-centered approach to learning, designers and developers of spaces are looking at how spaces around campuses can be used to support learning. The assumption that merely building a space with the proper facilities makes it an effective or useful learning space is being replaced with a more holistic approach. A space only becomes a learning space when the affordances within the space (e.g., furniture and facilities) create an environment where knowledge and ideas can flow freely to support learning.

3. Method

3.1 Procedure

The study was conducted at Nanyang Technological University, Singapore over a period of 9 months with a pilot study taking place in April 2016 upon gaining approval from the university's Institutional Review Board (IRB). A pilot study was conducted in September 2016 while the data for the study was collected at two points across Semester 1 for AY2016/2017.

The purpose of the pilot study was to understand how the various informal learning spaces around the university are being utilised by students. This was done by conducting an informal observation sweep which enabled the researchers to get a sense of the spaces available on campus. Based on existing literature and our research question, the research team piloted a survey questionnaire in 4 locations around campus. The survey captured anonymous student demographics, time and duration the space was utilised, and type of activities they were engaged. The open-ended questions captured the reasons students used a particular space and affordances that students thought were important to them.

The open-ended questions were categorised thematically, and the 10 most commonly coded themes were converted into "space satisfaction" statements that the respondents could state their level of agreement using a 4-point scale. The pilot survey questionnaire was refined to include both quantitative and open-ended responses and field notes were taken during the data collection. For the purpose of this paper, I will only discuss the space satisfaction section of the findings.

The first point of data collection was in September, which coincided with Week 3 of the semester while the second data collection was in November which coincided with Week 10 of the semester. These two data collection points were selected to understand if the dynamics of space changes across time. In total, 1,619 responses were collected in September, and 1,223 responses were collected in November.

3.2 Data analysis

The data collected were entered into IBM SPSS Statistics v23, a statistical tool for data analysis. An exploratory factor analysis (EFA) was performed on 2,842 respondents using principle components analysis with a Varimax and Kaiser normalisation resulting in three factors. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.74, above the commonly recommended value of 0.6, and Barlett's test of sphericity was significant ($\chi^2(45) = 6855, p < .05$). Five items with a range between 0.580 to 0.801 loaded onto Factor 1, three items with a range between 0.538 to 0.890 loaded onto Factor 2 and two items with a

range of 0.752 to 0.830 loaded onto Factor 3. There were no items in the data that was cross loaded.

4. Findings

This paper is part of a larger study that aims to understand how students utilise the various learning spaces around the university. However, to provide a context to the different learning spaces, we will discuss the spaces that were surveyed in this study which will be referred to as "managed" and "unmanaged" learning spaces.

Managed learning spaces are purposively built areas such as the library, study rooms and tutorial rooms that may be managed actively by a staff member during work hours. As the climate is hot and humid in Singapore, managed spaces are usually air-conditioned with facilities such as power sockets and specially designed tables and chairs that enable group or individual study. On the other hand, unmanaged spaces are transitional areas with tables and benches located within areas with high foot traffic such as outside the lecture halls, along the corridors or walkways between buildings, making it an ideal area to gather before class or in between classes.

The following sections will describe the three factors that affect the satisfaction of a learning space based on the EFA results.

4.1 Factor 1 - Comfort

The first factor that was loaded with five items is related to comfort. The term comfort in this study includes the way furniture is configured, air circulation, lighting, cleanliness and facilities (e.g., internet connection, power sockets) within the space.

Furniture configuration refers to the arrangement of tables and chairs within the space. The way the furniture is designed influences the way the space is being used and with learners expressing the desire for larger and more comfortable furniture (Harrop & Turpin, 2013). The furniture in unmanaged spaces is intended to withstand the elements which are more durable and hence less comfortable. On the other hand, the furniture in most of the managed spaces is slightly movable, reconfigurable with proper chairs and tables designed for studying.

Air circulation refers to the air quality and environment of a learning space. The research site is located in a hot and humid country with an average temperature of 27°C but is surrounded by a large green space. Air-conditioning is a norm in most of the spaces especially in the managed areas, but not all students enjoy the air-conditioning as the temperature may be too cold especially if they are in the area for long hours. Some students

responded that they preferred the natural outdoor breeze despite the warm and humid conditions.

Lighting refers to how much light is in a space, and plays an important role especially when the spaces are used for studying. Learners describe that lighting and natural light was an important factor when using a space (Harrop & Turpin, 2013). In this study, unmanaged spaces were located in areas that have natural lighting but required additional lighting in the later part of the day. Managed spaces are usually located within buildings which require additional lighting throughout the day to illuminate the space thus makes it well lit.

Cleanliness is part of the routine building management and upkeep of a space. In general, most of the spaces surveyed had high satisfaction in terms of cleanliness, but unmanaged spaces have slightly lower levels of satisfaction. This can be attributed to the fact that these areas are not fully sheltered and exposed to the elements which may affect their overall perception of cleanliness.

Facilities such as projectors, power sockets, and WiFi is becoming a norm in learning spaces. This study found many students using the space with laptops or their mobile devices. Therefore, the availability of power sockets was very important to students and spaces that did not have ample power sockets had a poorer satisfaction rate on their facilities.

In short, the “comfort” of a space is largely dependent on the location. For example, spaces located in an enclosed area such as the library or specially designed tutorial rooms is rated higher in comfort as compared with spaces such as foyers and walkways outside the lecture theatres which are not enclosed or air-conditioned. Areas that scored high on comfort are usually air-conditioned with furniture that can be slightly reconfigured such as movable chairs or tables that enable group discussion.

4.2 Factor 2 - Convenience

The second factor that was loaded with three items is called “convenience” which relates to proximity to classes, the restrictions on eating in a space (food restriction), and the ability to hold discussions. We found that the convenience of a space is highly related to whether the areas is located along the walkways outside the lecture theatres or areas that are on the way to the bus stop.

The proximity of a space to classes or along main walkways on campus was one of the factors that influences students’ preference on a space. For example, learning spaces outside the lecture theatres were convenient for students to meet up with others for group meeting or group study. However, this study found that students were willing to move around to different learning spaces around campus to their preferred learning space if it is not too far away from their own faculty.

There is a debate especially within the librarianship community (e.g., Bedwell & Banks, 2013) whether or not to allow food to be consumed in learning spaces. Most students in this study spend between 1-4 hours in each space. The ability to consume food and drinks would mean that students would be able to stay in the location for longer periods without having to move and stay focused longer (O'Connor, 2005). In this study, unmanaged spaces usually have no restrictions regarding the consumption of food but managed spaces such as the library may have restrictions in the type of food that may be consumed.

Depending on how students use a learning space, the ability to have discussions was also important. For example, students who are looking to study individually would prefer the library quiet zones while students having group discussions may opt to go to areas where there are open spaces and larger tables.

4.3 Factor 3 - Community

The third factor that was loaded with two items is related to community. Community in this study is defined as spaces that provides privacy and spaces where meetings are regularly held.

In this study, privacy encompasses two different meanings: privacy for individual study and privacy for collaborative work. For individual study, privacy would mean that the space is free from distractions such as heavy foot traffic or away from noise such as in the library quiet zones. On the other hand, privacy for students engaging in group meetings or group study would mean that the space allows for group work and discussion without being overly distracting to others.

Learning spaces are also areas where students gather to meet for both study and relaxation (Harrop & Turpin, 2013). From the qualitative data observation, we found that most students were working in close proximity to friends or peers although they may not be collaborating with each other all the time. The idea of working together was also observed by other researchers such as O'Connor (2005) who termed it as "studying along". This means that groups of students who are sitting together on the same table may not be necessarily studying the same materials but rather enjoy having the company of others who are performing the same task.

5. Conclusion

This paper discusses findings from a study that intends to understand how students were using learning spaces around the campus. Using a ground up approach, we identified three factors that can describe the satisfaction of a space which are comfort, convenience and community. This study found that the affordances within the space, and the location of the space plays an important role to the overall satisfaction. Although not discussed in this paper, the purpose of the using the space (e.g., individual study, group meetings, etc.) plays an important role towards the general satisfaction of the space. The next step of the study is to built a space typology by incorporating both the quantitative data from the survey and qualitative data (field notes and focus group discussions).

As space is a precious commodity for campuses around the world, this paper provides a framework for evaluating learning spaces for both administrators and space planners. Given that there can be infinite combinations of preferences, spaces can be designed and configured to meet the needs of students. More purposeful placing and design furniture and facilities changes the way the space is perceived and how the space is being used.

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Comparison of traditional lecture and flipped classroom for teaching programming

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Abstract

Programming courses in undergraduate education seem to be predestined for a flipped classroom approach as learning programming requires a high personal contribution on the one hand and on the other hand, course participants typically start with a wide range of previous knowledge and skills. Within a flipped classroom students can organize their learning phases self-reliantly and put an individual amount of effort into each learning objective. Whilst in a traditional lecture it is not easy to motivate students, the flipped classroom requires students' active involvement per se. Besides all these advantages, setting up such a course requires a high initial effort for the lecturer. Furthermore, students might prefer a lecture, as usually the work load is higher in a comparable flipped classroom course.

Based on the idea of flipping a beginners programming course, we firstly explored the effects of a flipped classroom approach on an elective advanced programming course with a smaller student group. The paper compares the new course design and its effects on the students learning, on the teaching, as well as on the course preparation with the former traditional lecture. The comparison is based on a survey, the students' evaluation feedback and on the examination results.

Keywords: *flipped classroom; computer science education; teaching programming.*

1. Introduction

Students enrolled in engineering often have difficulties with learning a programming language. The reasons are wide-spread. Butler and Morgan (2007) identify in a extensive survey among novice programmers in particular problems with abstract principles and logic. Bosse and Gerosa (2017) give an overview on the literature about programming difficulties. There are many different measures to enhance students' learning; starting from special programming languages to interactive visualization of programming concepts. We use, e.g. the *Virtual-C IDE* as a programming environment, which is especially designed for beginners, see Pawelczak and Baumann (2014). But this paper focuses more on teaching methods than on tools. Despite difficulties with abstract concepts Lahtinen et al. (2005) also find in their study, that most helpful for students' learning is writing programs on their own.

So, learning programming requires a high personal contribution. On the other hand, students' previous knowledge typically varies: some might have none or only limited experience with programming languages, some are already skilled or have developed misconceptions. For both scenarios, the concept of a flipped classroom (FC) appears promising, as it strengthens the self-engagement of the students: they have to prepare themselves on the basis of adequate course material; regular tests on the learning objectives and programming assignments keep students busy with the study matters and a review session gives the opportunity to detect misconceptions early. Although our primary focus is the education of novice programmers, we first want to test the FC on a smaller student group. We therefore use an elective advanced programming course. This paper presents the new course design and compares it with the former traditional lecture (TL) with respect to the students learning, to the teaching, as well as to the course preparation. We run a survey at the end of each course and examined both, the students' evaluation feedback and the examination results.

2. Related Work

FC is a common student-centered active learning method and has a rising prevalence in undergraduate education, compare Giannakos et al. (2014). Some benefits compared to a TL are the positive attitudes, and the increased engagement of the students. Although most studies emphasize an increased learning performance, there is no common agreement, that FC reveals better or more sustainable learning results. Kaplan (2015) e.g. compares a traditional CS1 course with an FC and describes typical challenges and draws the conclusion that FC students require more time to learn the same content. He also describes, that the effort for developing such a course is significantly higher. Lepp and Tonisson (2015) analyze the successful implementation of a beginners' programming course at Tartu University with about 70 % of the students thinking that they learned better and more compared to a TL. With regards to the high effort required to establish such a course, Lepp and Tonisson benefit from automated videotaping of lectures and can therefore refer to a large pool of

video material. Although not generally required for flipping a course, the use of videos is wide-spread and often discussed as a major benefit, which results in a better acceptance by students. Still, watching videos is time consuming and adds another common drawback of an FC: in TL students are trained independently of their preparation, while in FC students have to prepare themselves. Dazo et al. (2016) therefore analyze the video viewing behavior of course participants. They notice, that the viewing rate drops immediately after course begin and rises again before the examination. As course preparation is crucial, they suggest an automated reminder for students, to watch the videos prior to the lecture. Falling course attendance and students struggling with self-organization are other facts, that arise with the FC approach. For this reason, Köppe et al. (2015) published some guidelines on the in-class meetings to overcome these difficulties.

From the literature review, the objective of our research is to explore the effort for both – lecturer and students – for a course based on videos, clarify the acceptance of videos and get a sense, if flipping the beginners’ programming course is feasible as well. We keep in mind, that despite the success Lepp and Tonisson (2015) described, they performed the FC only with smaller student groups and used TL for large enrollments.

3. Former and New Course Setup

The course is an advanced C/C++-programming course. It is designed to expand a previous C course for beginners.

3.1 Former Course Setup

The former course comprised two hours per week each for lecture and lab work with seven programming assignments. In the first weeks, there is lecture only, while in the last seven weeks the lecture accompanies the lab work; typically, the lecture contents are 1-2 weeks ahead of the lab. The lecture prepares students for the lab work, but is kept quite general to give a wide overview on different topics. At the end of the course, there is a 2 hours final lecture and a 90 minutes written examination. The overall presence time is 4 hours a week. The preparation time is expected to be up to 3.5 hours, depending on the student’s skills. The course material consists of a detailed script, a list of book references, lecture slides and the work sheets for the lab work.

3.2 The New Course Setup

The new course concept starts with a 30-minutes kick-off, which gives a short introduction on the course contents, but mainly describes the course setup. The focus of the course is now the lab work: each 2-hours lab requires additional course material compared to the TL:

- *Preparation guide*: a short document describing the subjects of the next lab work: chapters to be read in the script, videos to be viewed and further reading information

in the script/ in books/ or in online sources. The guide also provides a set of questions to test the learning objectives.

- *Video material*: video cuts from the former courses lectures: the video material of 2 hours lecture is typically shortened to 1 or 2 videos with 10-30 minutes lengths.
- *Online questionnaire*: a quiz consisting of various questions from the preparation guide plus some small transfer tasks. In addition, it allows students to ask their own questions. The quiz has no direct feedback – it just collects questions and answers.

The time schedule for the lab work is organized as follows:

- A week in advance: release of the preparation guide & video material.
- Three days before the lab work:
 - issuing the work sheet for the lab work,
 - activating the online quiz,
 - invitation of the students to participate in the quiz.
- Review session the day before the lab: the lecturer moderates a 30-45 minutes discussion with the students about the questions and answers.
- After the lab: students get the next preparation guide and the schedule repeats.

The course ends like the former course with a final lecture and the written examination. The overall presence time is 2.5 - 3 hours a week. As a minimum, an hour per week is expected for video-based learning and answering the online quizzes. We estimated approximately two hours additional preparation time for the lab and for working with script and sources.

3.3 The Transition to the New Course Setup

The lecture of the TL course was videotaped in 2015. Students of this course already got access to the video material. The videos were typically put online a week after the lecture. The deployment of the videos had a negative effect on the lecture attendance: whilst in former lectures the attendance rate was typically about 80 %, it now dropped down to 64 %.

4. Data and Methodology

4.1. Course Evaluation

For the comparison of the courses a regular student evaluation is performed for each course with additional specific questions on the course material (both courses) and on the FC (only new course). The survey uses the Likert scale.

4.2. Data Basis and Comparison Setting

The survey was performed online in both courses, each time in the week before the last lab work. From 19 students in 2015, only 10 answered the survey, in 2016 we received the feedback from 10 out of 12 students. In addition to the survey outcome, we used the results

from the examinations. As students have no access to earlier examinations, we used exactly the same examination for a better comparison with some lexical modifications only. These were also marked according to the same scheme. For the lab work, the same work sheets were applied. In order to get an unbiased comparison, the course description was not modified: students learned in the first lesson that the course modalities had changed.

5. Results

5.1 Survey Results for the Flipped Classroom

As discussed in section 2, we expected a higher effort for course participants compared to the traditional lecture. As figure 1 shows, the majority of the participants disagreed on a higher effort (Q1 & Q2). One student stated the overall effort as higher. Of course, the results emphasize our intention of shaping the course with similar work-load. On the other hand, the overall learning content is reduced due to the focus on the lab work and less on background knowledge. Some video material from the traditional lecture was not issued to the students as it provides additional information, but is not directly related to the lab work.

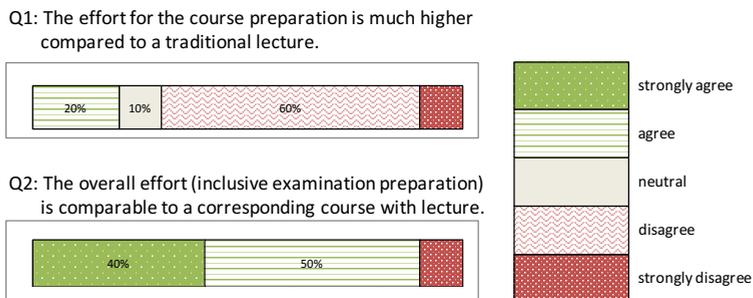
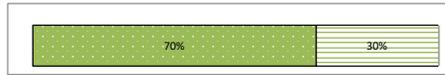


Figure 1. Q1 & Q2: Survey results with respect to the effort of the flipped classroom approach

Students were very content with the new course: 70 % stated that the course was more fun compared to a lecture-based course. Even 90 % agreed that they feel better prepared by themselves, compared to attending an equivalent lecture, compare Q4 in figure 2. This is the first course with the flipped classroom approach at our faculty; therefore, the new concept is certainly more approved. From the written comments in the survey, it was suggested to videotape and publish the review sessions as well. Of course, this would give students more freedom in their time to learn, on the other hand it contradicts the fact that some students need to be pushed to do their preparation: the average attendance rate of the review session was with 57 % lower than the attendance rate of the traditional lecture (64 %). The download rate of videos usually resembled the number of participants in the review session, but rose again before the lab work and the exam. We might conclude, that students who had no time for preparation, did not come to the review sessions.

Q3: The course makes more fun compared to an equivalent lecture based course.



Q4: I feel better prepared due to my own work on the course material compared to attending an equivalent lecture

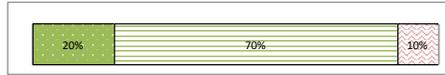


Figure 2. Q3 & Q4: Survey results regarding course enjoyment and self-assessment related to learning progress

5.2 Comparison to the Traditional Lecture

The standard course evaluation showed only tiny differences. On a German grading scheme (1- very good to 5- poor quality) the TL was rated 1.13 while FC received 1.17. Due to the small quantity of data, the difference is negligible, but as other results reveal, one student in the FC group obviously preferred the traditional lecture.

Q5: I would also use raw (unedited) videos for learning



a) traditional lecture

b) flipped classroom

Q6: Would I wish more detailed videos?



a) traditional lecture

b) flipped classroom

Q7: Videos can supplement a lecture but cannot replace it?



a) traditional lecture

b) flipped classroom

Figure 3. Q5 - Q7: Preferences regarding the video material in comparison.

As the effort for creating short and concise videos is very high, we asked the question if students would also use unedited video material from the lecture, compare figure 3. Interestingly more students from FC agreed on that, in TL more students declined that (Q5). Even more students disagreed on more detailed video material in FC, which indicates, that the effort of watching the videos is already high (Q6). We also asked the provocative question, whether videos can support a lecture but not replace it (Q7). In TL 90 % agreed with that, while in FC 60 % disagreed with that.

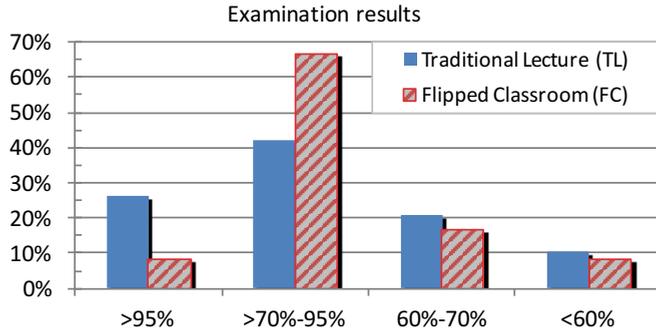


Figure 4. The examination results of traditional lecture and flipped classroom in comparison. The average points reached were 79.5 out of 100 for TL and slightly less with 78.1 points for FC.

The results from the examinations are hard to compare, as the group sizes are very small. The average points reached were quite similar, but the TL received slightly better results, compare figure 4: there is a higher number of best grades in the TL and the grades are more widely spread. It might imply, that TL clarified more details, or, that a misconception arose in the self-learning phase and the review session could not straighten it out.

5.3 Lecture's Experience with Flipped Classroom

The advantage compared to the TL is the strong focus in the review session: while TL often requires extra explanation and the lecturer has to go back further, the review session can concentrate on details. Of course, not all students are well prepared, still the level of detail is distinctly higher compared to the TL. This also has an impact on the learning atmosphere: the review session becomes an active discussion compared to a more unidirectional lecture and is "more fun" as the students stated.

The effort to set up the new course was very high. In future, adaption of the course material will be required and will again demand a high investment in time. Although the presence time of the lecturer was reduced by 1 to 1.5 hours per week, the overall time effort is definitive less for a TL.

6. Conclusion and Outlook

The benefits of the new course design are the high acceptance by the students as they seem more motivated in working with the course material at arbitrary times and – as stated in the survey – enjoyed the flipped classroom approach very much. The examination results show only tiny differences compared to previous courses and the students' workload was not reported as higher. The lecturer experienced a more inspiring learning environment as students were better prepared and discussions could be established on a higher level. We will therefore keep the flipped classroom concept for the course in the future. Besides the advantages, the flipped classroom course has drawbacks, i.e. the overall learning content is

reduced, as the focus is more on the lab work than on theory. We therefore plan optional additional tasks in the lab to extend the learning objects for interested students without increasing the general workload. The effort of setting it up was very high and as programming languages are evolving fast, the course material needs to be updated continuously. Despite the students' motivation, a tendency is discernible, that students delay their course preparation or skip the review session as they do not manage to prepare in time. It is hard to transfer the experiences to a beginners' course, as it is an elective course, which students choose, that feel familiar with programming. Probably more changes need to be made to motivate programming novices. Therefore, we refrain from our initial intention to flip the beginners' course for now as we want to gain more experience, first.

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Prediction of college grades in the sample of Norwegian students

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Abstract

In the present study we examine the relative impact of individual variables (school attendance, student learning efficacy, and behavioural intentions) and learning environment (LE; perceived justice, social identification, learning context, and organizational citizenship behaviour) on student grades. Participants comprised 201 students enrolled in a mid-size university in Norway. The individual predictors explained 30% of the variance in actual grades, with self-efficacy beliefs, non-mandatory school attendance, intentions to get a specific grade, and intentions to quit studying as significant predictors. The LE variables explained zero % (0%) of the variance in actual grades. None of the included LE variables emerged as significant in the final step of the regression analysis. The central point in the discussion is dedicated to the somewhat surprising finding that none of the LE variables contributed to explained variance in actual grades.

Keywords: college grades, individual variables, learning environment.

1. Introduction

The relationship between plausible theoretical candidates and academic achievements represents a well-explored area of research (see Richardson, Abraham, & Bond, 2012 for a meta-analytic review). Reviewing this research, it is possible to argue that there exist two different levels of analysis concerning this topic. The first one focuses on the learner's individual characteristics in terms of cognitions, motivations, and behavior and the way these dispositions influence learning outcomes (Harackiewicz, Barron, Tauer, & Elliot, 2002). The second approach emphasizes contextual aspects of learning environments and tend to focus on variables, such as organizational- and learning climate, and relationships among learners (Samdal, Wold, & Bronis, 1999). Pursuing the aim of adopting a broader theoretical approach, in the present study we simultaneously examine the relative impact of of (1) individual variables and (2) learning environment (LE) on student grades.

1.1 Individual variables

Individual variables included in our study refer to personal dispositions that are in lesser degree related to contextual influences that are embedded in the given learning environment. The first individual variable is school attendance that is in current literature frequently positively associated with academic achievements (Credé, Roch, & Kieszczyńska, 2010). The measure of school attendance in the present study is based on self-reported attendance in terms of automatic or habitual processes (Verplanken & Orbell, 2003). In addition to the measure of habitual school attendance we have also included an item that measures the degree in which students attend non-mandatory lectures. The second individual variable refers to self-efficacy beliefs and the quantity of time invested in doing required academic tasks. The positive effects of academic self-efficacy on academic achievements are well-documented (Sharma & Silbereisen, 2007). In addition, we also measure the quantity of time students invest in school work considering that concept of self-efficacy beliefs does not necessarily reflect efforts invested. The third individual variable refers to intentions to get a specific grade and intentions to quit studying. The concept of intention is in contemporary literature frequently identified as the most important determinant of volitional behavior (Ajzen, 1991). In addition, we also included a measure of intention to quit studying in order to capture motivational struggle to complete studies.

1.2 LE variables

The learning environment (LE) variables refer to processes that are to a higher degree associated with contextual influences. The first LE variable is perceived justice which refers to expressed perceptions about the extent to which people are treated fairly in given settings (Greenberg, 2010). According to Blader and Tyler (2005) perception of fairness have a vital impact on behavioral performance. The second LE variable refers to two different aspects of social identification. The first aspect, occupational identity, refers to the student's conscious awareness of oneself as a kindergarten teacher in terms of internalizing knowledge, skills, attitudes, and values that are characteristics of members of the profession. The second aspect of social identity is associated with the student's relation to their class in the kindergarten teacher education (Furrer & Skinner, 2003). The third LE variable refers to learning climate and basic learning orientations that characterize most learning. In the present study, we measure mastery orientation that characterized student learning context in form of stimulation of intrinsic motivation and general class support. And finally, we also included the measure of Organizational citizenship behavior (OCB) that consists of 3 conceptually distinct dimensions (Podsakoff, Ahearne, & MacKenzie, 1997): sportsmanship (the willingness to tolerate the inevitable inconveniences), civic virtue (constructive involvement in the organization), and helping behavior (voluntarily helping others). Previous research found positive association between OCB and academic achievement (Allison, Voss, & Dryer, 2001).

1.3 Dependent variable: academic achievements as measured in grades

Actual grades were assessed by obtaining registered exam results directly from the university office of student records. The Norwegian system of grading in higher education is a letter-grade system ranging from F (F = 1, non-passing) to A (A = 6, highest possible). These letters were converted to a point system (1 to 6), respectively.

1.4 Hypotheses

To summarize, we sought to test the following hypotheses:

1. We hypothesize that academic achievements as measured in grades are significantly predicted by individual variables.
2. We hypothesize that academic achievements as measured in grades are significantly predicted by LE variables.
3. We hypothesize that individual variables are better predictors of academic achievements as measured in grades, compared to LE variables.

2. Method

2.1 Data collection and participants

Participants comprised 201 university students enrolled in a mid-size university in Norway. The data was collected over a two-week period by asking students to complete the questionnaire prior to lectures in classrooms. In the previously provided cover letter, we asked participants to report their student number. The students were also explicitly informed that they could fill out the questionnaire without filling in the student number if they did not have it available. At the end of the semester (approximately four months after data collection), we gave the list of student numbers to the administrative office. This office provided us with the grades for each participant. The procedure was in advance approved by the university and the Norwegian Social Science Data Services (NSD). Instruments in the study consisted of self-reported measures that had been used in previous research with a similar purpose (Kovač, Cameron, & Høigaard, 2016). The reference to instruments that were used could be found in the introduction part as attached to each individual and the LE variable.

3. Results

3.1 Predicting actual grades with individual variables

We performed a hierarchical regression analysis in which actual grades were regressed on planning (step 1), self-efficacy beliefs and the quantity of time invested in doing required academic tasks (step 2), habitual school attendance (step 3), non-mandatory school attendance (step 4), intentions to get a specific grade and intentions to quit studying (step 5). In the final regression equation, the predictors under consideration explained 30% of the variance in actual grades, with self-efficacy beliefs ($\beta = .16$, $p < .05$), non-mandatory school attendance ($\beta = .25$, $p < .01$), intentions to get a specific grade ($\beta = .23$, $p < .01$), and intentions to quit studying ($\beta = .19$, $p < .01$) as significant independent predictors. The results provide support for hypothesis 1 which states that academic achievements as measured in grades are significantly predicted by individual variables.

3.2 Predicting actual grades with LE variables

The second regression analysis was also performed in which actual grades were regressed on social identity variables (step 1), components of OCB (step 2), perceived justice and learning climate (step 3), and sense of inclusion at (step 4). In the final regression equation, the predictors under consideration explained zero % (0%) of the variance in actual grades. None of the included variables emerged as significant in the final step of the regression analysis. The results do not provide support for hypothesis 2, which states that academic achievements as measured in grades are significantly predicted by LE variables. The results provide however support for hypothesis 3, that individual variables are better predictors of academic achievements as measured in grades, compared to LE variables.

4. Discussion

The results reveal that hypothesis one is supported. Thus, academic achievements as measured in grades are significantly predicted by individual variables. As implied in the introduction, this finding is expected considering that effects of individual variables used in the current study are well documented in previous research. However, hypothesis two is not supported by the present findings. The results show that the accumulated effect of LE variables on academic achievements as measured in grades is non-existent. Although we anticipated the predictive dominance of individual variables compared to LE variables (hypothesis three), the results reveal virtually no relation between college grades and contextual influence. Our anticipation was based on previous research suggesting that a supportive learning environment is important for high academic achievement (Wang & Holcombe, 2010). The one possible explanation for this finding is that the effects of LE on academic achievement is indirect and mediated by the workings of individual dispositions. Support for this reasoning is visible in the descriptive analysis of the covariate positive relation between individual and LE variables. Thus, it is possible that LE variables set a basis or background for the development of individual processes that directly influence college grades. This would mean that LE variables nevertheless are important in the sense that they form a contextual setting that stimulates efforts and self-confidence in learners. The effects of positive LE are central to academic achievement, but they are channeled through the number of individual variables.

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A Note on the Pedagogies about Comprehensive Learning: An Empirical Study in Teaching Finance Courses

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Abstract

This paper is an empirical study to examine the effectiveness of different pedagogies in knowledge perception. The study uses data from 562 students during the period from 2012 to 2016 that measures students' performance in the Finance courses aligned with the commonly implemented pedagogies in teaching. The results from the empirical tests verify the theme proposed by Richard L. Gregory (a prominent British neuropsychologist) that learning is achieved through a process of analogizing and aligning the new information with available and stored knowledge in the brain, and the continuous efforts to discover and solve the problems in learning bring about this effectiveness. The study provides a detailed assessment for different pedagogies in teaching that offers reflections on effectiveness for teaching and learning.

Keywords: Pedagogy, Education Research, and Finance

1. Introduction

The effectiveness of teaching on students' comprehension and learning is truly a combination of the efforts between students and instructor. When students are unable to keep up their learning efforts with the class – i.e. a lack of effort towards learning beyond class attendance and inability to review and prepare for the course materials in a timely manner and to complete the assigned homework independently and responsibly – the lecture or class discussion may bring very little to them. This paper is an empirical study to examine the effectiveness of some commonly implemented pedagogies in teaching that formulate a comprehensive approach intended to achieve learning effectiveness, to stimulate students' learning efforts and to improve the learning outcomes.

Scientific evidence shows that visual perception is more than ninety percent of the total bandwidth perceived by the brain encoded into memory, while less than ten percent is sensory nerve signals¹. Without students' conscious effort to perceive and comprehend the information delivered in the course, what is taught in the classroom might never approach the students effectively. Thus, the application of the current understanding of perception to the various pedagogies in learning and teaching is the theme of this study.

This paper starts with the literature by Richard L. Gregory, a prominent British neuropsychologist, known for his work in perception, as a basis for providing insight on the pedagogies discussed in the paper. This study reviews and tests the learning outcomes when the instructor used *pop quizzes, projects and simulation assignments*, as well as an *e-learning software package provided by textbook publishers* to improve students' learning outcomes. The study is based on the data of 562 students from different classes over the period from 2012 to 2016. Could pop quizzes adequately stimulate students' timely preparation for class materials? Does e-learning software packages offered along with textbooks improve students' learning outcomes? Do projects and simulation assignments that are designed to enhance and broaden students' learning interests beyond classroom produce intended or expected results? With empirical data as the objective measure for different pedagogies' learning outcomes, the study searches for answers and believes this paper raises interesting points that may be helpful as a reference as educators continue to strive for comprehensive learning and teaching effectiveness.

¹ Gregory, R. L. (1997). Knowledge in perception and illusion. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 352(1358), 1121–1127.

2. Literature Review: Knowledge in Perception and Illusion by Richard L. Gregory

Richard L. Gregory shows in his article, *Knowledge in Perception and Illusion* (1997), that we do not see what the eyes see while we see what the brain sees. He wrote “*Philosophy and science have traditionally separated intelligence from perception, vision being seen as a passive window on the world and intelligence as active problem-solving*” while “*...vision, requires intelligent problem-solving based on knowledge*”. He believes learning is a process that combines two senses of intelligence: potential intelligence and kinetic intelligence. Learning is a process that recognizes new information through actively aligning and analogizing this new information with the available and stored answers in the brain. “*The notion is that stored-from-the-past potential intelligence of knowledge is selected and applied to solve current perceptual problems by active processing of Kinetic intelligence.*” “*The more available knowledge, the less processing is required; however, Kinetic intelligence is needed for building useful knowledge, by learning through discovery and testing.*”²

Richard L. Gregory indicates in his study that learning is a self-initiated process. Obtaining new information is accomplished through a process of analogizing and aligning the knowledge available and stored in the brain. Comprehensive learning is achieved by continuously assessing the information that is approaching and solving the problem in the process. An effective pedagogy facilitates the purpose of learning adequately and improves the learning outcomes generated.

3- Data, Variables, and Models

This paper is an empirical study to examine the effectiveness of learning with the pedagogies developed and implemented for Managerial Finance courses that optimize the learning outcomes. The course of Managerial Finance I used in the study is an introductory required course for all Business majors including the students with options of Accounting, Finance, Marketing, Management, and International Business; while Managerial Finance II is a required course for the students in the upper level Business major with Finance option only. The study examines the learning outcomes when the instructor used some commonly implemented pedagogies, such as pop quizzes, projects and simulation assignments that are closely related to the contents covered in the courses, as well as an e-learning software

² The sentences were extracted from page 1121, Gregory, R. L. (1997). Knowledge in perception and illusion. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 352(1358), 1121–1127.

package provided by the publisher of textbook to improve students' learning outcomes. Given similar pedagogies implemented for the two courses, Managerial Finance I and Managerial Finance II, the study also contrasts the learning outcomes generated between the students of the two courses. The following explains the details of the database, the variables and the models designed for the study.

3.1 Data

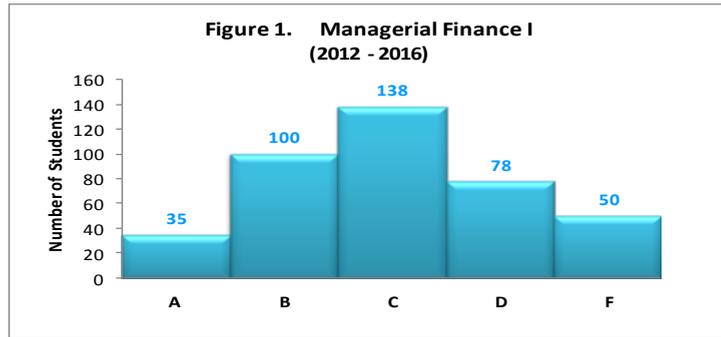
Two sets of data tested in the study are related to the two courses explained above. Data set one is based upon 17 sessions of the Managerial Finance I class over the period from 2012 to 2016, and 401 students (observations) are included in the test³. Most students who were attending Managerial Finance I were sophomores or juniors in the university. Data set two is based upon 5 sessions of Managerial Finance II over the same period of 2012 – 2016 while 161 students (observations) are included⁴. The students included in the data set are juniors or seniors. Managerial Finance II was offered once a year during that time period, while Managerial Finance I was offered throughout the year, including fall, spring, and summer semesters.

According to the overall grades received at the end of the semester, the students who are included in the first data set, the Managerial Finance I class, can be distributed as follows:

Grade Received	Number of Students	% of the Total
A	35	8.73%
B	100	24.94%
C	138	34.41%
D	78	19.45%
F	50	12.47%
Total	401	100%

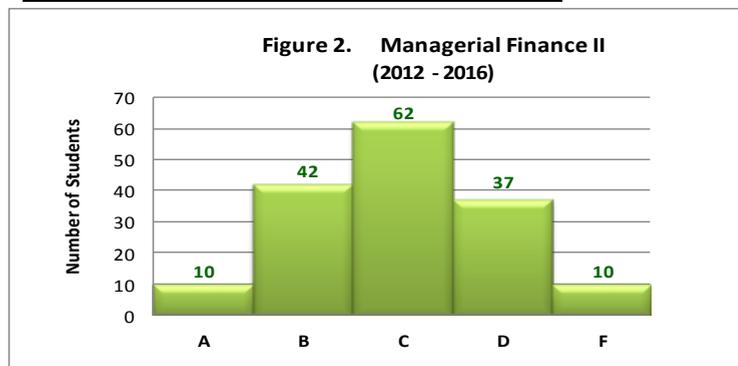
³ The data covers the period from Spring 2012 to Fall 2016 and the course was offered every semester including summer sessions. The observations in the data include all the students who attended and completed the classes at the end of the semester, excluding the students who dropped the classes during the semester.

⁴ The data covers the period from Spring 2012 to Fall 2016 and the observations in the database include all the students who attended and completed the classes, excluding the students who dropped the class during the semester, and/or who did not complete the course at the end of the semester.



According to the overall grade received at the end of the semester, the students who are included in the second data set, the Managerial Finance II class, have the following distribution:

Grade Received	Number of Students	% of the Total
A	10	6.21%
B	42	26.09%
C	62	38.51%
D	37	22.98%
F	10	6.21%
Total	161	100%



The distributions of the overall grades (A to F) between the two courses, Managerial Finance I and Managerial Finance II, are quite similar with grade C accounting for the highest frequency (34.41% and 38.51% respectively). The frequency for grade B is higher than the frequency of the grade D (24.94% and 19.45% for Managerial Finance I while 26.09% and 22.98% for Managerial Finance II), and the number of the students who failed

the course is larger than the number of the students who received A (50 receiving an F and 35 receiving an A, or 12.47% and 8.73%, respectively) for Managerial Finance I, while the numbers are even (10, or 6.21% of the class total) for Managerial Finance II.

3.2 The Variables Designed for the Test

The two courses have been implemented with similar pedagogical approaches that are commonly used in teaching. The variables included in the model reflect the measure of students' performance across different categories through the semester, including scores from final exams, midterms, pop quizzes (and its variation), project assignments and homework assignments from the textbook and the e-learning software package. The explanations of the variables are listed below:

Exams: Two midterm exams and one final exam are scheduled for Managerial Finance I while one midterm and one final exam are given for Managerial Finance II. Final exams are comprehensive while midterms focus on assigned chapters. The test scores carry 50% weight of the overall grade of the course for Managerial Finance I; while the test scores carry 60% weight of the overall grade of the course for Managerial Finance II. The variable *Exams* is a weighted average of multiple exams and is designed as a proxy to measure the learning outcomes.

Quizzes: The variable *Quizzes* is an average of the pop quiz scores for the entire semester multiplied by the weight of the quiz score with respect of the overall course grade formulation. In a given semester, an average of 8 pop quizzes are given throughout the semester (weekly, excluding the first weeks of class and those with midterm or final exams). Quizzes are designed to check the students' understanding of the learning in a timely fashion, and usually are one-page of multiple choice questions and/or conceptual problem solving lasting 5 to 10 minutes to complete. If students remain diligent regarding coursework, the expectation and bar for the pop quizzes is such that students should do well.

Measurement for Continuous Learning Efforts (MCLE): The *MCLE* variable is the variation of the quiz scores calculated by the standard deviation of the quiz scores divided by the mean of the quiz scores through the semester. Thus, a smaller *MCLE* value, in general, reflects a more consistent performance, indicating that the student has kept up his/her learning steadily through the semester.

Project Assignments: Students receive multiple project assignments and mini case analyses during the semester. The assignment intends to connect the textbook contents

with real business practices (beyond the classroom) to improve the students' problem solving abilities, often exercising independent comprehension of information learned. This variable is measured by the average score of the project assignments weighted by the project assignments' contribution in the overall grade of the course. This measurement is a positive contributor to learning outcomes.

Connect: *Connect* is an e-learning software package provided with the textbook by the publisher (McGraw Hill). Every student is required to sign up a *Connect* account at the beginning of the semester. The homework questions/problems for each chapter are assigned through *Connect* with a due date to complete the assignment. Before the due date, students are granted unlimited attempts to work through the *Connect* homework questions to replace and improve their score. Therefore, timelier completion of the *Connect* homework assignments is expected to result in higher scores on *Connect*. Furthermore, students receive explanations and/or tips for learning if they have difficulties in working out the problems that is built in the software. Thus, *Connect* supplements students' coursework efficiently with a personalized learning style. The *Connect* variable is calculated by the total score of the homework, including all the chapters, multiplied by the weight of *Connect* assignment scores in the overall grade, and is also expected to be a positive contributor to learning outcomes.

3.3 Test Models

Three linear regression models were designed to interpret the learning outcomes. Each model reflects a selected pedagogy and measures its contribution to the learning outcomes. They are explained as follows:

Model 1 was designed to measure the contribution of timely and consistent effort towards learning, and is defined as

$$\text{Exams} = \alpha + \beta_1 \text{Quizzes} + \beta_2 \text{MCLE} + \varepsilon \quad (1)$$

where *MCLE* is a measure of the variation of the quiz scores as it is explained above.

We expect timely and consistent learning effort contributes positively to the effectiveness of the learning outcomes.

Model 2 is a measure of the effectiveness of the *Connect* e-learning software package form of consistent chapter-by-chapter homework assignments to supplement the textbook material, by the publisher (McGraw Hill). Working on the homework assignment

independently and consistently reflects a process of obtaining new information through analyzing and aligning the knowledge available and stored in the brain, and we expect the model will reveal a positive contribution to the learning outcome. The model is defined as

$$\text{Exams} = \alpha + \beta_1 \text{Connect} + \varepsilon \quad (2)$$

Model 3 is a comprehensive measure of students' learning efforts *beyond the classroom*, which includes the homework assignment based on the textbook through *Connect* and the project and simulation assignments aimed to connect the textbook contents with real business practices to improve students' problem solving. The model is defined as

$$\text{Exams} = \alpha + \beta_1 \text{Connect} + \beta_2 \text{Project Assignments} + \varepsilon \quad (3)$$

The study expects that the test results will reflect whether the various pedagogies implemented in the course improve students' learning outcomes. This will provide evidence to support Richard L. Gregory's theme of knowledge in perception: learning is a process to combine two senses of intelligences: potential intelligence and kinetic intelligence, whereby "...stored-from-the-past potential intelligence of knowledge is selected and applied to solve current perceptual problems by active processing of Kinetic intelligence"⁵. An effective pedagogy facilitates the combination of the two intelligences and thus optimizes the learning outcomes generated.

⁵ The sentences were extracted from page 1121, Gregory, R. L. (1997). Knowledge in perception and illusion. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 352(1358), 1121–1127.

4. Empirical Results

Table 1 below reports the results from Model (1) that tested if the pop quizzes stimulate students' learning effort to review the class material timely and thus improve the learning outcomes.

Table 1: Learning Outcomes vs. Timely and Consistent Learning Efforts

<u>Panel A: Managerial Finance I (Observations = 401)</u>			
α Value)	β_1	β_2	F-value (P- Value)
Variable	(Adjusted R ²)	Quizzes	MCLE
Coefficient	48.0582	4.9985	-14.8297
T-Value	16.3271	13.3809	-6.6438
42.6251 (3.97E-62)			
P-Value	(3.08 E-46)	(5.61E-34)	(1.007E-10)
(0.5061)			
<u>Panel B: Managerial Finance II (Observations = 161)</u>			
α Value)	β_1	β_2	F-value (P- Value)
Variable	(Adjusted R ²)	Quizzes	MCLE
Coefficient	37.1498	0.5857	-13.2285
T-Value	8.6612	1.322	-3.8868
26.0888 (1.62 E10)			
P-Value	(5.162E-15)	(0.188)	(0.00014)
(0.2387)			
Model: $Exams = \alpha + \beta_1 Quizzes + \beta_2 MCLE + \varepsilon$			

The results reported in Table 1 show a positive relationship between the *Quizzes* and *Exams*, and additionally, a negative relationship between *MCLE* (measure of the variation of quiz scores) and *Exams*. The coefficient for *Quizzes* is positive and statistically significant for Managerial Finance I class while it is positive but not statistically significant for Managerial Finance II class. The results indicate timely quizzes catch up students' learning efforts and timely review does contribute to the learning outcome. Moreover, the coefficient for *MCLE*, which measures the variation of quiz score (i.e. a larger *MCLE* indicates more variation in quiz scores), is negative for *Exams* in both class, and is statistically significant in both classes, indicating steady and consistent learning efforts improve the learning outcomes. The test results show the model in both classes is statistically significant. The adjusted R² indicates the *quiz scores* and *the variation of quiz*

scores contribute to the variability in learning outcomes by 50% for the course of Managerial Finance I, whereas for the Managerial Finance II course, the value is 24%.

Table 2 shows the empirical testing results of Model (2) which examines the relationship between the learning outcomes and the completion and scores of *Connect* homework assignments:

Table 2: Learning Outcomes vs. Completion of Homework Assignment at the Text Book

Panel A: Managerial Finance I (Observations = 401)

Variable	α F-value (P-Value) (R Square)	β_1 Connect	
Coefficient	23.9596	4.9985	
T-Value	20.0468	0.668	
P-Value	50.974 (4.46E-12) (0.1133)	(4.46	E-12)

Panel B: Managerial Finance II (Observations = 161)

Variable	α value (P-Value) (R-Square)	β_1 Connect	F-
Coefficient	25.9064	0.6777	
T-Value	11.0893	4.8619	
P-Value	23.6383 (2.77 E-06) (0.1294)	(1.573E-06)	(2.77 E-06)

$$\text{Model 2: Exams} = \alpha + \beta_1 \text{ Connect} + \varepsilon$$

The regression results reported in Table 2 reveals a positive and statistically significant relationship between the score earned in *Connect* and the performance of the exams. Note, a higher score in *Connect* reflects a timely and consistent completion of homework assignments for every chapter, which ultimately leads to an improved performance on the exams. As expected, the results in Table 2 show a significantly positive relationship between *Connect* and *Exams* for both courses. The R^2 indicates how students' completion of *Connect* homework contributes to their exam scores, with an R^2 of 11.33% for the Managerial Finance I class and 12.94% for the Managerial Finance II class.

Finally, Table 3 shows the results from Model (3) which examines the impact of the pedagogy that incorporates the overall students' learning efforts beyond the classroom to

the exams as a measure of learning outcomes. Effort beyond the classroom included the completion of homework questions through *Connect* and the project assignments and mini-case analyses that bridge the textbook with real business practices and thus improve the students' abilities for problem solving. It is reported as follows:

Table 3: Learning Outcomes vs. Overall Student Learning Efforts beyond Classroom

Panel A: Managerial Finance I (Observations = 401)

	α	β_1	β_2	F-
value (P-Value)				
Variable		Connect	Projects	
	(Adjusted R ²)			
Coefficient	4.8522	0.4261	26.6641	
T-Value	1.5599	4.4296	6.5985	
49.9748 (4.333 E-20)				
P-Value	(0.11658)	(1.22 E-05)	(1.32	E-10)
(0.1967)				

Panel B: Managerial Finance II (Observations = 161)

	α	β_1	β_2	F-
value				
Variable		Connect	Projects	
	(Adjusted R ²)			
Coefficient	8.7853	0.2719	2.9823	
T-Value	2.6788	1.9807	6.7231	
37.7049 (4.097 E14)				
P-Value	(0.00817)	(0.04935)	(3.07	E-10)
(0.3145)				

$$\text{Model: Exams} = \alpha + \beta_1 \text{Connect} + \beta_2 \text{Project Assignments} + \varepsilon$$

The results in Table 3 are interesting and affirm the propositions of *Knowledge in Perception and Illusion* by Richard L. Gregory. Both coefficients for *Connect* and *Project Assignments* are positive and statistically significant for both classes, Managerial Finance I and Managerial Finance II, indicating that the learning efforts beyond the classroom do produce and contribute significantly to the learning outcomes – namely, *Connect* homework that links to the textbook and projects that connect to the textbook contents through real business cases. Moreover, the results show a higher degree of significance for the coefficient of *Project Assignment* to the learning outcomes than that of the coefficient of *Connect* for both courses, asserting learning with active problem-solving may be more effective. The results support the theme of the study proposed by Richard L. Gregory well. Learning is a consistent process that recognizes new information by actively aligning and analogizing the knowledge confronted and with that obtained, and an effective pedagogy facilitates and promotes this learning process.

5. Conclusion

This paper is an empirical study to examine the effectiveness of different pedagogies in teaching that intends to promote knowledge in perception. In more detail, the study tries to explain whether the commonly used pedagogies in teaching do in fact stimulate students' learning efforts and improve their learning outcomes. The study is based upon the work of Richard L. Gregory in knowledge of perception. Richard L. Gregory believes that learning is a self-initiated process, and obtaining new information is a process of aligning and analogizing the knowledge already available and stored in the brain. Learning is achieved by continuous effort to assess information, unlocking discoveries and solutions to presented problems and questions.

The empirical study of this paper uses the data of 562 students during the period of 2012 to 2016 for two Finance courses, Managerial Finance I and Managerial Finance II. The data – various measurements of students' performance in the courses – in the study tested commonly used pedagogies implemented in teaching. The test results support the theme of the study and our anticipated expectation. It shows pop quizzes are an effective approach to motivate students' timely reviewing for what they are learning. The significant negative relationship between variation in pop quiz scores throughout the class and the resultant exam scores further points out that learning requires steady and consistent effort. The e-learning software package, *Connect*, provided with the textbook allows students to supplement their course work through the semester, and the results in the study show that consistent studying on *Connect* assignments more adequately equips students to perform better on exams. Learning beyond the classroom through projects and case analysis assignments that bridge textbook contents with real business practices enhance learning because it actively analogizes and aligns the knowledge available and stored in the brain, and thus improves students' abilities to discover and solve real-world problems in learning.

Timely and consistent learning efforts with active problem-solving results in effective learning. Teaching effectiveness should explore and improve the pedagogies that achieve effectiveness of knowledge in perceptions.

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A successful institutional policy of quality postgraduates at the UABC

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Abstract

This paper analyzes the postgraduate institutional policy in the Autonomous University of Baja California (UABC) implemented since 2003. Aligning the educational model of the UABC with the parameters of the National Program of Postgraduate Quality (PNPC in spanish), the results-based budget and the matrix of indicators of the logical margin and articulating them to the maximum qualifications of national recognition granted to the full time professors at higher education institutions, its results are explained by the continuity of the policy and organizational capacity of the institutional management, which has resulted in the improvement of the quality and coverage in the postgraduate level, achieving from 2013 that 100% of its programs are recognized for their quality and the first institution of the 34 state public universities existing in the country to reach it sustainably. This policy implemented by the UABC also should be reflected in the satisfaction of graduates and employers, in the contribution in the generation of knowledge through journals high impact factor, the degree of linkage with the productive sector measured through collaboration agreements and management of resources for public-private-social projects, which will be topics for future research.

Keywords: Higher quality education, higher education policy; postgraduate; public policies evaluation.

1. Introduction

In the last 20 years, an increasingly interconnected world environment and a progressive specialization and technological development in almost all areas of knowledge, have been transformed the economic and socio-cultural sphere. This has generated a process of intense global competition among almost all countries seeking better living conditions and welfare for their inhabitants. Higher education institutions through postgraduate as a means of transformation and knowledge management, undertake the challenge of transforming, diversifying and expanding their educational offer to improve their competitiveness and answers graduates to the needs and demands of the labor market (Mungaray, 1994). The creation of postgraduate programs includes high-level human resources training to address national problems and priorities through science, technology and innovation in strategic areas that detonate economic development. On the other hand, "the quality of a postgraduate degree [...] does not depend on the type of institution that offers it, the target population it attends or the educational function for which it forms, but on a curriculum design with a good level of internal congruence with attainable objectives and an operation totally coherent with its main purpose" (Moreno, 2002). This quality is measured by its relevance, social impact and scientific-technical relevance. The challenge currently faced by graduate education programs in Mexico is to scale the professional and academic level of postgraduate education programs that allow them to raise their level of quality and relevance, which in turn are sustainable and sustainable in the long term In response to changes in the academic sector and that respond to the needs of the labor market driven by economic sectors and contribute to knowledge and its application in solving local, regional and international problems (ANUIES, 2000; Moreno, 2002; Rubio, 2006).

2. Conceptual aspects on the evaluation of public policies

In the field of public policy evaluation, there is a whole discussion as to the best analytical framework for locating and evaluating the results, since the analysis based on assumptions based on empirical evidence prevails, but without any analytical framework that supports them. De Vries and Álvarez (2005) argue that in the policy analysis "an analytical framework is necessary that considers a wide range of factors that affect the public policy and allow hypotheses that are tried in the reality that they try to describe and to understand". To do this, it is convenient to consider the analyzes on the political structure to evaluate results and impacts, the using of techniques of measurement of integral analysis that complement hard data (quantitative information) with surveys that provide information of a subjective nature (qualitative information). In the field of the evaluation of higher education policies, there is a wide discussion about the characterization, trends, implementation, administration, organization, reforms and institutional arrangements within

educational systems and subsystems (Dawkins, 1987; Mungaray and López, 1996; Barrow *et al*, 2003; Roth, 2007). From these analyzes, some of them have broken out in lines of action to promote the development of higher education at a global level such as those proposed by UNESCO (1995). At the national level, these same elements of analysis are present, linking them to the different historical moments of national politics (ANUIES, 2000, Luengo, 2003; OECD, 2004 and Rubio, 2006). With the introduction of the Results-Based Budgeting in Mexico since 2008, public expenditure planning is sought with a focus on achieving results using the Logical Framework Approach. The UABC has implemented this methodology in its planning process to facilitate the monitoring and evaluation of its budgetary programs linked to the results of the policies and strategies of the institutional development plans 2011-2015 and 2015-2019.

3. Methodology

The hypothesis of the present work is that the improvement of the quality and coverage in the postgraduate level is the result of a focused policy and of the organizational capacity of the continuous institutional management in the last fourteen years within the framework of the UABC educational model (2006). The main focus are the full-time professors (PTC). Through its activities, studies or projects in disciplinary and multidisciplinary subjects, product of basic or applied research. This allows them to deepen their field of knowledge of the disciplinary areas of educational programs as an integral part of the teaching-learning process. By sharing similar topics and common academic objectives, these teachers formalize Lines of Generation and Knowledge Application, conforming themselves to Researchers Groups certified by the Ministry of Public Education of Mexico. Once they consolidate their capacities, lines and research work, they acquire the PTC Certified whose recognition is also done through an evaluation process by the Ministry of Public Education and / or enter the National System of Researchers (NSR) through National Council of Science and Technology of Mexico (CONACYT in spanish), contributing in an important way to the consolidation, strengthening and maintenance of the quality of educational programs. The accreditation and recognition of the quality of the postgraduate programs guarantee the quality of the training of the human resources in the institution and answer the solution of national and local problems.

4. UABC postgraduate indicators

4.1 Full time professors (PTC) and PTC Certified

The intensification of the globalization process and the knowledge society have touched the universities and all its members in the world. The UABC has assumed the vision about the important role of the researcher teacher in relation to the challenges they face in the years to come. The evolution of the PTC Certified in the UABC, has grown significantly since 2002, at an average annual rate of 13.6%, passing from 27% out of total PTC to 69% in 2016, placed in the second best national effort among autonomous public institutions in Mexico. This new profile is undoubtedly a new seed capital for the formation and consolidation of the academic bodies of the institution, whose recognition is done through an evaluation process by the Ministry of Public Education of Mexico, with teaching, generation or innovative application of knowledge, mentoring, academic management and linkage in a balanced manner.

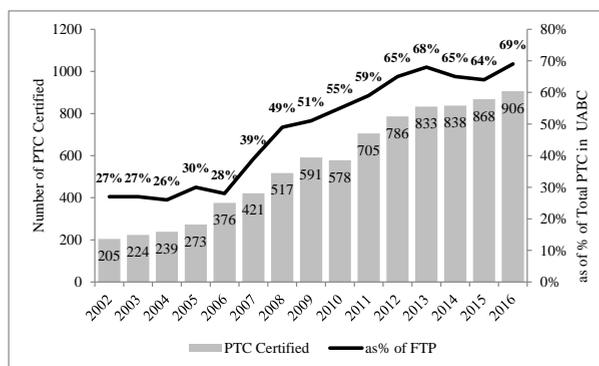


Figure 1. UABC PTC Certified 2002-2016.

Source: own elaboration.

4.2 National System of Researchers (NSR)

In 1984, Ministry of Public Education of Mexico created the NSR "with the aim of increasing international competitiveness in research, linking and solving national problems, as well as recognizing activities related to scientific and technological research with quality, training Specialized human resources, high performance and efficiency through the provision of economic incentives" (DOF, 1984). Based on this, the UABC has been continuously promoting an annual increase in the number of academics who belong to the NSR since 1999, by promoting research and teaching as a synergy for the benefit of teachers and students in general. At the end of 2016 (Figure 2) the UABC has 333

academics in the NSR, of which 86 are Candidates, 196 Level I, 40 Level II and 11 Level III. By levels and with information available since 2010, there is a transition between levels, which indicates that research in the institution generates quality in its contributions and projects and that resources and human capital are being formed at a high level. This has allowed the UABC to be the educational institution of Baja California where the largest human capital with scientific and technological capacity is concentrated, from 24% of the institution's SNIs in 2002 to 46.5% in 2016 (Figure 3).

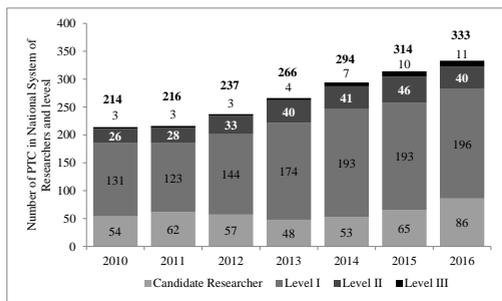


Figure 2. NSRs at UABC 2010-2016.

Source: own elaboration.

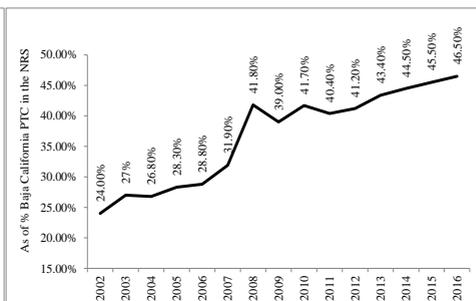


Figure 3. UABC NSRs / Baja California NSR 2002-2016.

Source: own elaboration.

4.3 Researchers Groups Certified

The Researcher Groups Certified of the UABC have been consolidated from the previous experience of their members research and collective work for their relationship with teaching in graduate programs. This has allowed to achieve an optimal performance of its students and the training of competitive professionals whose capacities can be located in the labor market. As can be seen in Figure 4, from 2002 to 2006, the figure of Groups is shown in the UABC and from 2007 to 2010 its consolidation is prioritized. As of 2011, institutional policy follows a two-pronged strategy: to continue with the consolidation of the Groups and to enable the creation of new ones as a response to the growth PTC Certified, as well as to the need for teachers to explore new lines of research and establishing collaborative links through national and international networks.

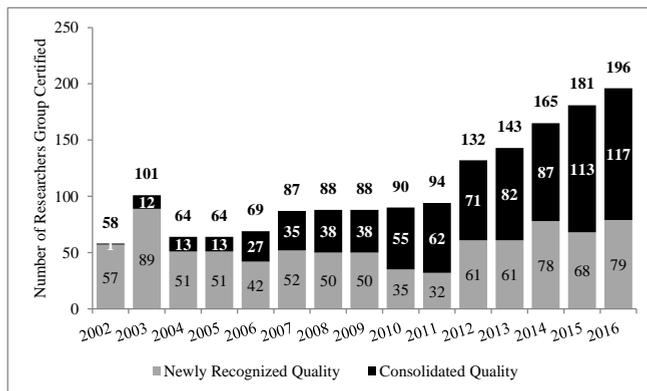


Figure 4. Researcher Groups Certified at UABC 2002-2016. Source: own elaboration.

4.4 UABC postgraduates programs incorporated to the PNPC

Since 1991, the Ministry of Public Education and CONACYT have been promoting the public policy of promoting postgraduate qualifications in Mexico through “the recognition of the quality of postgraduate programs offered by higher education institutions and research centers, through rigorous peer review processes, and is awarded to programs that demonstrate they have met the highest standards of quality and relevance” (CONACYT 2015). The quality is observed in the transit of UABC postgraduate programs enrolled in the PNPC at levels in Development and Consolidated between 2010 and 2014. This transit has been possible due to the greater qualification of PTC with graduate level in the NSR and in the improvement of level of the Researchers Group Certified. This has also strengthened academic competencies, investigative skills and resource management within their respective Main Core Academic. As it shows in Figure 5, from the 43 UABC postgraduate programs in the PNPC, 5 are Newly Quality Recognized, 21 Consolidating and 11 Consolidated. Also, 19 of these programs are professionally oriented (44.2%) and 24 are research oriented (55.8%). With the postgraduate quality assurance policy that is implemented in the institution and with the effort of the university community, the UABC achieves in 2013 that 100% of its graduate programs are enrolled in the PNPC, becoming the only institution of the 34 state public universities in the country to reach and sustain it.

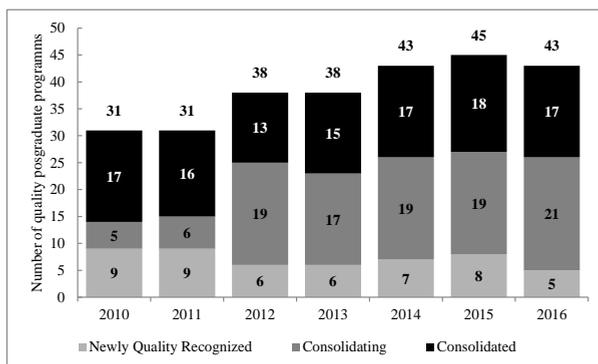


Figure 5. UABC Postgraduates programs in PNPC 2010-2016. Source: own elaboration.

5. Concluding Remarks

Achieving the quality of the postgraduate programs required by the scientific and technological community through CONACYT, requires a great effort. At the same time, it represents a great challenge to remain accredited once the acceptance to the PNPC has been achieved, which becomes part of the institutional stress and creativity. That is why 100% of the 43 postgraduate educational programs offered by the UABC enrolled in the PNPC are addressed as strategic issues, with the aim of raising efficiency and effectiveness levels through continuous improvement, quality and transparency. Although the effort of the country's Higher Education Institutions to increase the quality of its postgraduate courses is evident, there are two outstanding subjects in terms of evaluation and accreditation that guarantee its sustainability and continuous improvement. On the one hand, at the federal level, it is necessary for the State to maintain improvement actions in the evaluation and accreditation processes, but also in the instrumentation and monitoring of the indicators that measure the performance of the postgraduate programs. On the other hand, it is required that at the state level, modifications to the certification and accreditation processes be undertaken in a more rigorous and comprehensive manner, regulating the opening and operation of postgraduate programs in public and private higher education institutions with approved quality criteria with the PNPC. This would allow all market-driven efforts to be addressed with quality and not only with credentialist criteria and economic profitability. For the UABC, the future main challenge is to guarantee the articulation and congruence between our institutional practices, with the criteria of the evaluating and accrediting agencies of the programs, in order to have the same harmony and stay in the competition. The creation of a postgraduate program aims to materialize the professional activities of scientific research, in the training of human resources at the highest level of quality. A key component in the relevance and sustainability of the quality of a postgraduate program, is

the academic commitment of PTC who make up the Main Core Academic of each program, from the selection of candidates to the follow-up to their insertion in the workforce. This training cycle, coordinated jointly and collegially by all those involved in a quality postgraduate offer, is what holds 100% of the quality postgraduate in the UABC.

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“University Challenges”: Addressing Transition and Retention through Games-Based Learning

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Abstract

In the changing UK Higher Education landscape, addressing student retention and attrition rates is of increasing importance. In this paper, after first reviewing literature on the factors influencing student retention and attrition, we explore how the transition to university life for first-year students might be addressed through a games-based learning approach. We explore the benefits of facilitating ‘students as (games) producers’ and incorporating ‘student intelligence’ into university teaching and learning practices before presenting ‘University Challenges’, a new-traditional board game produced through a collaborative staff-student project between sociology students and lecturers at Leeds Beckett University. Drawing on data from student evaluations from three different academic courses, we reflect on how playing ‘University Challenges’ can help first-year students develop the kinds of skills and knowledge basis that contributes to a better experience of the transition and acculturation into university life in all of its facets.

Keywords: *games-based learning; retention; attrition; students as producers; induction.*

1. Introduction

Within the changing UK Higher Education landscape students' successful transition into university, measured by their ability to progress into the second year of study, has become a key performance indicator. Retention and attrition are significant issues for universities and higher education funding councils and increasing attention has been given to how to improve student retention and to explore the causes of attrition (Wilcox et al., 2005; O'Keefe, 2013; HEFCE, 2013). Student attrition costs universities in terms of lost revenue whilst also not reflecting well upon the institution (Longden, 2009). Overall, non-continuation rates for undergraduate students vary according to discipline and a range of factors both endogenous and exogenous to the university itself are important. Rates have slightly risen to 6% in the latest figures produced for 2013/14 entry (HESA, 2016) but in our disciplinary area - sociology - non-continuation rates are higher reaching with 10.7% in the 2012/13 entry (HEFCE, n.d.), although they have been slightly decreasing recently. For a variety of reasons, student dis-continuation is slightly above sector average in our institution and student retention is therefore an issue for course management. However, our focus here is less with the institutional frame and more with the wellbeing and experiences of our students. Acculturation to university life and expectations is a key concern for students wanting to succeed on their course and avoid the expenses associated with dropping-out or repeating a year. Thus, this paper charts how we have attempted to collaboratively address these concerns through a staff-student project exploring how the transition to university life might be smoothened through game-based learning, resulting in an extended induction or 'long thin induction'.

2. Attrition, Retention and the First-year Transition

Experiences in the early weeks of university life are important in influencing students' decisions to withdraw from their course (Wilcox et al., 2005). It is widely agreed in the literature that the transition to university life presents both opportunities and a range of significant challenges for first-year students. They are required to negotiate a variety of new experiences in order to 'fit in' with both the academic and social aspects of university life (Wilcox et al., 2005). New students have to deal with factors such as relocation, separation from family and friends, living with strangers and adjustment to new expectations around independent learning and academic life more generally. These challenges substantially impact upon their sense of identity and belonging and can generate feelings of disorientation (Briggs et al., 2012), or isolation and loneliness (Scanlon et al., 2007). In this context establishing a 'new' identity and a sense of belonging through relationships with peers, and to a lesser extent staff, appear key (Wilcox et al., 2005; Scanlon et al., 2007).

In their small-scale qualitative research on first-years who withdrew from or stayed on their social science course, Wilcox et al. (2005) argue that retention issues are complex and

multifaceted. Amongst leavers the main difficulties centered around social issues (making friends, feeling lonely and lacking emotional support), academic issues (course fit, expectations mismatch, independent learning) and material issues (accommodation, finance, location). In particular they emphasize the importance of social support and networks as $\frac{3}{4}$ of leavers mention difficulties with making friends. As Yorke and Longden (2007) argue in their review of research around retention, simply making friends is crucial to a successful transition into higher education.

In the context of wide-ranging changes to HE, and particularly an increasingly diverse student body, attention has focused on how HE institutions might better understand student transitions and provide more appropriate student support. Here the induction period has been identified as important. O’Keefe (2013) argues that creating a sense of belonging by course tutors is crucial whilst, at the same time, avoiding information overload in the induction and the first weeks of study (Hamshire & Cullen 2010) which students can perceive to be bewildering. Rather, using this period as a chance to build and establish positive peer friendships, coaching and mentoring relationships amongst students may prove particularly fruitful (Briggs et al. 2012).

In terms of creating a more positive transition, Longden (2009) has argued that institutions are recognizing the value of a ‘longer and thinner’ induction experience that starts early and lasts longer than one week. This de-emphasizes the bewildering first week, and provides more opportunity for new students to assimilate and make sense of the information provided. Furthermore a range of activities can (with less emphasis on alcohol, which could alienate some students) help students and staff to socialize and to engage in and belong to the HE community at their institution. Related to that, Kift et al. (2010) propose a ‘transition pedagogy’ that encourages students to become members of a community of learners and recognizes that first-year students have particular needs based on the transition experience. This approach likewise sees transition not as an introductory event, but as a year long process with curriculum as a thread to which other aspects of transition must be added (Bowles et al., 2014).

3. Students as Producers of Games

We have discussed elsewhere some of the key tenets of the ‘students as producers’ discourse (Gerodetti and Nixon, 2014). One of its foundational principles is to explore ways in which ‘student intelligence’ can be incorporated into teaching and learning practices ‘through collaboration with academics on research projects of real intellectual value’ (Neary, 2012: 2). We have successfully applied the principles of this discourse in a previous collaborative project with students who created games that can be used to teach research methods and ethics (Gerodetti and Nixon, 2014). A key observation from our game-design workshops and watching our students play the games with other students during testing was the positive social relationships that were built amongst students from different year groups both making and playing the game. Older students reveled in coaching and mentoring less experienced students, who appeared to feel reassured by the advice they received.

Given the characteristics of first-year transition experiences discussed above and the positive social and interactive attributes associated with new-traditional games (Gerodetti and Nixon, 2014), a ‘transition game’ or a game that can be played during a long induction process that addresses issues new students face would appear to offer a range of potential benefits. These include providing a context for socializing and building relationships with new course mates, developing a reassuring awareness that others share their fears, information sharing and collective and collaborative problem-solving. In designing games, students as game producers is a useful approach to address transition issues because they have recent experiences and expert knowledge of making, and are still in the process of making, such transitions. Strikingly, students highlighted that the game could address both academic and non-academic issues.

Unlike another project (located in Health Care) with an all-lecturer design team (see Hamshire and Forsyth, 2014), we centralized our students’ experiences giving them the task to design a game which would not only introduce first-year students to common concerns and problems but also encourage them to collaboratively construct solutions to dilemmas posed in the game. The game, as it stands, was designed by sociology students (from different year groups) with no background in game design. The learning objectives were defined collectively as; to develop an awareness of issues commonly encountered by first-year students; to develop skills and knowledge to solve such issues; and to develop a student community based on shared values. This final objective shaped the decision to develop a new traditional game which could be played in groups. In building collective knowledge and addressing common students issues, a student community with shared values and shared knowledge may be fostered through playing the game. These learning objectives were achieved through the content of the game and collaborative play.

problem-solving skills. Notably, five of the six categories within the game address non-academic areas of student life such as 'Health & Safety', 'Accommodation', 'Personal', 'Finance', 'Social & General Knowledge'. Only one category pertains to 'Academic' issues, which strongly reflects our student designers' agenda. Interestingly, our student game designers' agenda is supported by the literature on the issues influencing retention discussed above. Significantly, the focus on empowering students as (game) producers and in being student-led in game-design is different to Hamshire and Forsyth's (2014) tutor-led game, which over-emphasized academic issues.

5. Evaluating 'University Challenges'

The game has undergone a testing phase as well as a full evaluation of the second iteration which was played, in different ways, by first-year students from sociology, politics and games design. On the sociology course the game was played within the first seminar of a module and facilitated by second year students who had been involved in the games development process. Sociology students (N=76) overwhelmingly provided good to excellent feedback on the game, including some qualitative comments that they really liked having the opportunity to engage with second-year students in the course of playing the game. Thus a strong mentoring aspect accompanied the use of the game in sociology. By contrast, the politics team used the games within several small group tutorials and used the game's questions and dilemmas explicitly as a prompt for further discussion. This resulted in the game not being completed within the 50 minutes session. Feedback from the tutor indicated that both the tutor and the students liked the idea and the questions to discuss issues in more detail, but were frustrated with not completing the game. No evaluations were returned from the students. On the games design course 16 students played the game in a self self-administered way within a module that examines games design and game mechanics across a variety of currently available games including board games. Game design students, mostly male, were rather less impressed by the former look and design but were also frustrated by the instructions which they found cumbersome.

The overall evaluation of the game points to it generally fulfilling the learning objectives. For example, 60.9% of students thought the game was either 'quite' or 'very' useful in helping familiarize themselves with their new university environment (see table 1). More significantly, 70.6% thought that it was 'quite' or 'very' useful in learning about student issues and 70.8% thought it was 'quite' or 'very' useful in getting to know other students - two of the key learning outcomes formulated at the beginning of the development process. However, the game was less successful in relation to the third learning objective as only 53.2% of students reported that the game was 'quite' or 'very' useful in helping find diverse solutions to various problems.

Learning Outcomes	Not useful	A little useful	Quite useful	Very useful
How useful did you find the game in familiarising yourself with Leeds Beckett University?	N=10 10.8%	N=26 28.3%	N=39 42.4%	N=17 18.5%
How useful was the game in familiarising yourself with student issues?	N=11 12%	N=16 17.4%	N=45 48.9%	N=20 21.7%
How useful was the game in becoming more familiar with diverse solutions?	N=11 12%	N=32 34.8%	N=36 39.1%	N=13 14.1%
How useful is the game in getting to know other students?	N=6 6.5%	N=20 21.7%	N=44 47.9%	N=21 22.9%

Table 1. Student Evaluation 2016-17 from first year students from BA (Hons) Games Design (N=16) and BA (Hons) Sociology (N=76)

One of the weaknesses of the first iteration of the game was its slow pace and so the second iteration, when played as a competitive game, is designed to take 35-50 minutes to play, thereby fitting into conventional times slots often used in teaching. Students were asked to rate the game on a scale of 1-10 (10 being highest). 64.1% scored the game between 7-10, 22.8% between 4-6 and 13.0% rated the game 1-3 (all but one of the games design students for which there are a number of reasons).

6. Conclusion

Transition into HE is not just marred with problems and it is worth remembering that most students transition ‘successfully’. Students are an increasingly diverse body that experience transitions in different ways and with differential access to resources and social and cultural capital. Research on first-year transitions and retention suggests the relationship is complex and multi-faceted. Nonetheless it is possible to identify common issues that cut across both ‘stayers’ and ‘leavers’ experiences, but perhaps particularly affect ‘leavers’; these are namely ‘social’ aspects as well as ‘academic’ and ‘financial’ ones. Our student game-designers built their own tacit knowledge and experience of transitioning into the mechanics of the game. Along with gaining deeper knowledge of ‘student life’, it is our contention that the game also encourages positive social interaction amongst first-year students (and peers in older cohorts), ultimately helping the development of the peer support and friendship networks that appear so important for the successful transition to university life.

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Innovative Learning Analytics Research at a Data-Driven HEI

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Abstract

A university campus is comprised of Schools and Faculties attended by students whose primary intention is to learn and ultimately graduate with their desired qualification. From the moment students apply to a university and thereafter gain acceptance and attend the campus they create a unique digital footprint of themselves within the university IT systems. Students' digital footprints are a source of data that is of interest to groups including teachers, analysts, administrators and policy makers in the education, sociology, and pedagogy domains. Learning analytics can offer tools to mine such data producing actionable knowledge for purposes of improving student retention, curriculum enhancement, student progress and feedback, and administrative evolution. In this paper, we summarise three ongoing Learning Analytics projects from an Irish university, demonstrating the potential that exists to enhance Higher Education pedagogical approaches. First year students often struggle with making the transition into University as they adapt to life and study at a Higher Education Institution. The research projects in the area of Learning Analytics at our institution focus on: improving test performance using analytics from a general-purpose VLE like Moodle, identifying studying groups and the performance peer effect using on-campus geolocation data, and detecting lower-performing or at-risk students on programming modules.

Keywords: *Learning Analytics; Personalised Learning; VLE; Student Retention; Early Intervention; Data Mining.*

1. Introduction

From the moment a student applies to a University, each becomes a continuous source of data, especially relating to their activities on the campus. Each student can be defined by their own unique digital footprint which comprises of a number of components including:

- Demographic information
- Previous academic history
- Assignment and exam results
- Library attendance and book withdrawals
- Activity on University Virtual Learning Environments (VLEs)
- Use of ICT (Information Communication Technology) resources
- Access to WiFi or other networking systems
- Math Learning Centre and other drop-in centre records
- Class attendance, where measured

Learning Analytics in the context of our research projects can be defined as the collection and mining of a student's unique digital footprint to understand their interactions with each other and with the University systems. Siemens and Long (2011) advocate that Learning Analytics provides various degrees of actionable intelligence for learners, Faculties, course administrators and decision takers at departmental levels. We believe that the value goes further and can extend to students' external supports, including families.

The following three sections outline three individual and unique Learning Analytics projects, each using students' digital footprints in some way to positively benefit students.

2. Predictive Educational Analytics Using the University's VLE Logs

Research by Calvo-Flores (2006) has shown that student grades can be predicted with a good level of accuracy using features derived from the activity logs from a Learning Management System. The challenge that we address, is how to generate predictions of student grades in first year undergraduate classes, and how to use these predictions to help students achieve better results. Our solution does not require any input or interaction from Lecturers as instead, we provide direct feedback in terms of performance prediction and in recommending content to study, to the students themselves. Our solution was implemented at Dublin City University across a wide range of first year undergraduate modules over a two-year period. Analysis of the examination results for students from the first year of this study shows an increase in test scores for the majority of modules, that this was implemented for with some modules such as Mathematics for Business, achieving very significant improvement when comparing students who opted into receiving this feedback.

Overall, our work demonstrates that students respond well to automated interventions and that this does help to improve overall student performance and thus student retention.

We found that depending on the module type, and how far into the module content that we were (i.e how many weeks of semester), we could predict student exam outcome based on a cross-validated Area Under the Receiver Operating Characteristic (ROC AUC) as a performance metric for our binary functions. The ROC AUC score for modules we used in our work varied widely between modules. We found that the modules which were best suited to this sort of analysis had an ROC AUC score of 60% to 70% by the end of the semester. We also validated our predictions on a module, made while the module was still in progress as against the results achieved by the students. The F1 score, another evaluation metric which is the harmonic mean of precision and recall, for the prediction made in the final week was generally was between 70% and 90%, again depending on the module. This work was implemented across a cohort of 1,095 first year undergraduate students, of which 725 students chose to opt in to receiving this weekly feedback. We also observed a 3.5% improvement in actual exam mark between those who opted into the study and those who chose not to. (Corrigan (2015)). Once it is demonstrated that it is possible to predict students' examination grades with a reasonable level of accuracy, it is important to use this to help students in some way. Our overall goal is to use these predictions to assist students in improving examination performance, improve their learning experience and thus to improve student retention in University.

Our solution to the prediction challenge, is to build a model based on historical data. Test this solution using cross-validation to ensure that the predictions accuracy and then, using a regression model, we predict scores that the students are likely to obtain. We then repeat this process for every week of the semester. Once we predicts the grades that each student will likely receive, we developed a web application where students could check their own exam predictions weekly. This is presented as a chart showing how well the system believes each student is likely to perform relative to their peers as the prediction shown to students is their predicted place in class, in deciles. A sample of the personalised graph for just one module that students can visualise is shown in Figure 1. This graph illustrates that in week 12 of the semester (x-axis), this particular student in module SS103 was predicted to come only within the top 90% of the class (y-axis) and their whole semester shows a gradual decline in relative placing throughout the 12 weeks.

In addition to predicting place in class, we also sent tailored weekly alerts which included specific recommended resources taken directly from the LMS content for the course module that was deem to be helpful to the student. This is based on a case based recommender which uses data about online LMS 4 resources used by peers from the class who have a week-on-week prediction of a higher place in class, with a specific focus on LMS content that the student has not yet viewed.

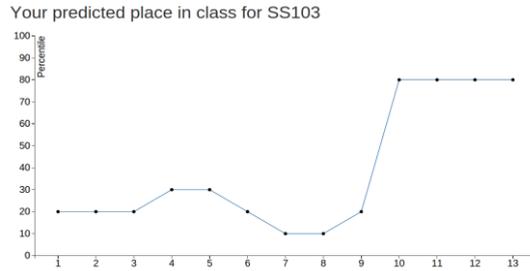


Figure 1: Week-by-week prediction for one student in one module. Source: Dublin City University (2016)

3. Wifi Geolocation Data, Student Groups and the Peer Effect

There has been a multitude of studies and research in the areas of the influence on an individual, of the heterogeneous social groups to which they become members. Within the educational domain the research emphasis is on the impact of peers on the academic performance of a student. Much of this research is reliant on data collection methods that are invasive, require participants' recall or are obvious to the subjects that they are part of a study. Recent developments in the area of formative educational methods have enabled other data collection options. Digitally collected data such as student digital footprints, has many advantages over that compiled manually through more traditional collection methods. Data-sets collected digitally are less susceptible to the inherent biases introduced through the intervention of human interpretations, furthermore it is often structured, complete and traceable. When a student registers with the university they are allocated unique credentials for use with the campus IT assets. As a student uses these IT assets they lay down a unique digital footprint.

This project examines an aspect of the digital footprint generated by students through the interaction of their wifi-enabled devices and the campus-wide Eduroam system. Using historical logs this project is carrying out a longitudinal analysis of the interactions among individual students and thus identifying group memberships. Once a group's members are identified, we correlate academic performance between group members and analyse how interaction with their peers affects their academic performance.

We identify which students interact on a continuous basis both within the framework of the scheduled lectures and labs and in areas where gatherings are more social, or are in shared studying locations. To ensure our research differentiates between the context of meeting places we subdivided the campus into academic (formal) and social (informal) locations.

Our hypothesis is that individuals become members of a number of emergent groups in the early stages of interaction before forming "friendships" within groups. We are further

exploring whether groups they become members of will influence academic performance. Figure 2 illustrates a wifi platform digital footprint captured between September and December 2014. This of second year students registered in one of the School of Computing’s programs. It presents a pattern identifying Tuesday having a high level of wifi activity and Friday the lowest. This activity correlates with the programs academic timetable, i.e. there are no formal classes scheduled on Fridays. This figure also illustrates that as the semester progresses students spend more time on campus on Fridays, presumably in additional studies either individually or as part of a study group.

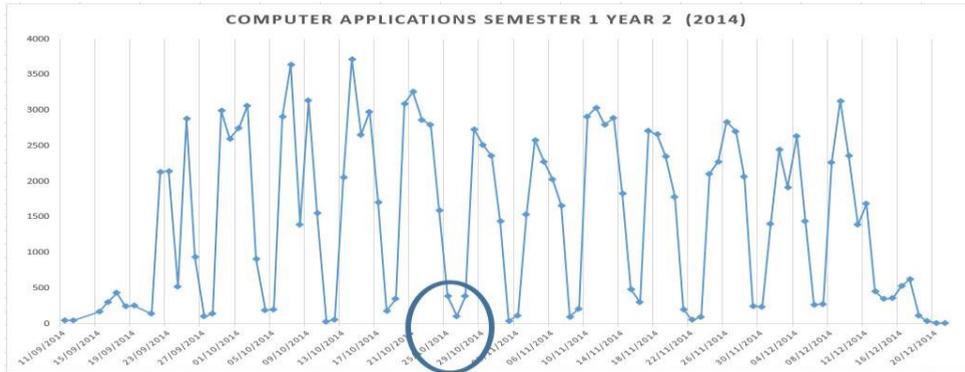


Figure 2. Wifi digital footprint. Source: SAP Hana and Predictive Analytics (2014).

Having identified each student’s unique interaction with the wifi platform we can use a co-location algorithm to identify groups based on time, location and the number of their dyad interactions. Table 1 provides an example of the number of meetings between student pairs by location and category, i.e Academic or Social. It can be seen that the dyads with the smallest delta mark had both a large number of meetings in both Academic and Social locations. This can be construed as identifying students who spend a large portion of their time together in both Academic and Social setting, as friends and share similar academic abilities.

Student 1	Student 2	Academic Meetings	CLASS	LABS	LIBRARY	Social Meetings	HANG OUT	TRANSIT	RESIDENCE	Total MEETINGS	DELTA
d399224566b1406f883f88af289337a	fccd00bacc7327d417e56d1ebdb67189	2588	1458	1130	0	355	222	127	0	2943	2.67
a878d00ec27f559e67e8071b4f4638ee	d399224566b1406f883f88af289337a	2682	774	1908	0	217	121	94	2	2899	4.25
53f4fe49d759074c22be50786f9ff07	d399224566b1406f883f88af289337a	2455	796	1659	0	104	72	24	8	2559	16.34
d399224566b1406f883f88af289337a	f7aa5c504eff400c312b8664be16ea8d	1479	415	1012	52	471	360	87	22	1950	4.92
d399224566b1406f883f88af289337a	f0381e3ba5f776e7c3cbf6ed0f3e3888	1824	476	1348	0	114	59	55	0	1938	9.92
f0381e3ba5f776e7c3cbf6ed0f3e3888	f68fda980005140df86bb6429ae0133e	1160	710	320	130	453	373	78	2	1613	0.58
d399224566b1406f883f88af289337a	f7fb4a52b3bc08ada78be4813b7d9e85	1351	586	765	0	149	58	81	2	1500	15
6ccbc030e54c7bf1dbf95f275e0570a	d399224566b1406f883f88af289337a	1376	532	844	0	102	65	37	0	1478	16.84
9b1c28c05fa9cc7a2c877c9168b5ea80	a878d00ec27f559e67e8071b4f4638ee	1106	536	489	81	282	207	36	39	1388	13.75
757e5e772c0bace6801026a805be617	d399224566b1406f883f88af289337a	1217	389	828	0	61	51	10	0	1278	10.42

Table 1. Student Dyad by location and exam delta.

An accepted methodology in the examination of the interaction of students within groups and communities, is Social Network Analysis (SNA). Wasserman et al. (1994) were one of the earliest exponents of SNA being utilised to examine the interaction among students. We propose that SNA can be used to identify patterns and relationships amongst individuals, groups and communities within our study. Using SAP Hana and SAP Predictive Analytics Social Network analysis tools we have identified student friendship dyads and are carrying out network analysis between group membership and academic performance of the group(s) members. In the remainder of this project we will correlate group membership with academic performance and identify the optimum group size for shared exercises. We will also measure demographic features and academic performance and carry out feature extraction of students who disengage from the university. This behavioral analysis could allow early identification of students likely to opt out of study.

4. Computer Science and Personalised Programming Learning

We know that students' digital footprints commence prior to their arrival at the university as demographic and GPA (CAO points) are collected at the time of application. We analysed 950 first-year Computer Science (CS) entrants across a seven year period through the Leaving Certificate entry route. Early analysis showed a high correlation between the entry level GPA and first year final exams aggregate as shown in Figure 3.

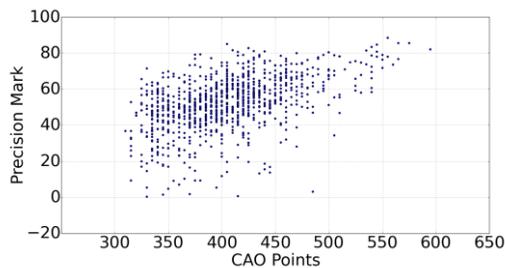


Figure 3. University entry points vs First-year precision mark. Source: Dublin City University (2010-2016).

At Dublin City University, 304 students dropped out over the last six years and 64% of these happened during their first year of studies in CS. We trained a machine learning algorithm to identify first-year CS students who might face difficulties before they even arrive on-campus to start their programme. The function is based on student characteristics including Age, Gender, Nationality, Domicile, Access route to campus, etc; and University Access exam scores: Irish Leaving Cert: GPA (CAO points) and Individual Exam level and results. Student Support and Services at Dublin City University are monitoring our analysis for the incoming cohort of 2017 students. Students who might be at risk based on their

characteristics and entry points are being contacted and offered help. The learning algorithm we used is a Random Forest (which consists of multiple Decision Trees). The training data is very imbalanced throughout the six years (21% of failures, which are 251 students), and this algorithm maximizes the metrics for the negative class.

Class	F-score	Precision	Recall
Fail Class	28.70%	30.93%	29.12%
Pass Class	83.36%	82.09%	83.44%

Table 1. Random Forest metrics

Source: Dublin City University (2010-2016).

This approach, based on static student information, doesn't take into account the student's effort or learning throughout the year and won't yield great insights. Thus, real-time analytics are being gathered from a custom learning environment (VLE) developed for the teaching of programming modules. Students can browse the module's material and submit their laboratory work online. Program submissions are verified in real-time on every upload. Every interaction with the material online and the programs developed along with the results are tracked, forming a digital footprint for each CS student who uses the platform. For each module leveraging the platform, a predictive model has been developed using historical data. The models, developed using machine learning techniques, predict student performance based on programming skills acquired and web interaction events. Students are assessed by taking laboratory computer-based programming exams and the passing likelihood is the target of our predictions. The empirical error minimization approach has been employed to pick up the learning algorithm with the fewest empirical errors from a bag of classifiers for each module analysed.

A learning algorithm was built for "Computer Programming I" in 2016-2017 using only one year of training data. Reports to lecturers was sent every week outlining real-time predictions about the students performance. Students struggling with the module could be identified at a glance plus the confidence of our classifier for each student. The classifier selected was Logistic Regression which also gives an associated probability.

Student	Fail / Pass Prediction	Fail Prediction Confidence	Pass Prediction Confidence
John Doe	Pass	26.95%	73.05%
Jane Roe	Fail	69.27%	30.73%
Johnny Smith	Pass	27.03%	72.97%

Figure 4. Prediction probabilities snapshot . Source: Dublin City University (2016).

At-risk students were targeted during laboratory sessions by lecturers and laboratory tutors. We cluster students in two cohorts depending whether they failed or passed their first laboratory exam. The learning improvement between these two groups was 11.52% in 2015/2016 and 50.26% in 2016/2017 when assistance was offered to weak students. The differential learning improvement on average was then 4 times more on the academic year the predictions were run and reports sent, than on the previous one, and at-risk which means students learned 4 times more.

Personalised programming recommendations are coming as student feedback the following semester. We are expecting an impact on student engagement and learning on these CS modules.

5. Conclusions and Future work

Learning Analytics gathers student data about their learning progress and this raw data can be processed and turned into actionable knowledge which Faculty administrators and Lecturers can use to identify students having difficulties on courses or at university life in general. We have found that our VLE (Moodle) and custom in-module predictions reach a usable accuracy that increases towards the end of the semester. At our University, we are excited to provide tools that help and encourage student learning right across the campus. In this paper we have shown three examples where some part of students’ digital footprints - their access to the VLE, their interaction with the campus WiFi and their interaction with an in-lab programming environment - can be usefully mined for such actionable knowledge.

We need to bear in mind when we are comparing our results between lower and higher-performing students that the former have more margin for improvement and if the latter maintains their academic performance, then this is already an accomplishment. In addition, we are in the process of aggregating different data sources about students, combining their characteristics with in-module analytics or geolocation data to better understand their digital footprint and make more informed decisions.

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Researcher, PI and CEO - Managing a Large Scale Environmental Restoration Project in New York City; Creating Expectations, Establishing Structure, Protocols and Realistic Outcomes

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Abstract

Research consistently shows that children who have opportunities to actively investigate natural settings and engage in problem-based learning greatly benefit from the experiences? This project developed a model of curriculum and community enterprise to address that issue within the nation's largest urban school system. Middle school students will study New York Harbor and the extensive watershed that empties into it, as they conducted field research in support of restoring native oyster habitats. The project builds on the existing Billion Oyster Project, and was implemented by a broad partnership of institutions and community resources, including Pace University, the New York City Department of Education, the Columbia University Lamont-Doherty Earth Observatory, the New York Academy of Sciences, the New York Harbor Foundation, the New York Aquarium, and others. The project model includes five interrelated components: A teacher education curriculum, a digital platform for project resources, museum exhibits, and an afterschool STEM mentoring program. It targets middle-school students in low-income neighborhoods with high populations of English language learners and students from groups underrepresented in STEM fields and education pathways. This paper explores the management of this large-scale project and provides insight with regard to the governance of the various project components.

Keywords: *project-based learning, environmental restoration, educational technology*

1. Project Summary

1.1 Project Summary

The “*Curriculum and Community Enterprise for the Restoration of New York Harbor with New York City Public City Schools*” is both an education and restoration initiative. The project begins with the vision that public school curricula; particularly in STEM-C content areas, can be enhanced by explicitly linking teaching and learning to a localized environmental science project that demands authentic research, data collection, and experimentation. In New York City there are numerous local environmental problems that merit inquiry based science research by students; however none is more fundamental than the question of human impact on our watershed. The Billion Oyster Project provides the original vision and framework by which the project operates and functions <https://www.billionoysterproject.org/>.

New York City is the terminus of a regional watershed that encompasses more than 17,000 square miles, four states, and approximately 20 million people. When the water of the combined Hudson, Raritan, and Bronx River watershed arrives in New York Harbor it meets the Atlantic Ocean and forms one of the largest and the majority of well-protected natural harbors in the world. The 300-square mile estuary that surrounds and comprises New York City was, at the time of European arrival, also one of the most biologically productive and resilient ecosystems on the planet. For more than 250 years the vast fisheries of the Upper New York Bay and Hudson River both nourished the people and propelled the wealth of the city. Arguably no species was more essential—or more abundant—in the building New York City than the native East Coast oyster, *Crassostrea virginica*. The historical extent of the New York Bay oyster included more than 200 square miles of reef and hundreds of billions, if not trillions of individuals. At this scale the oyster was inarguably the original ecosystem engineer of New York Harbor. Its power to attenuate waves, continuously filter impurities, and shelter complex communities of marine life is unmatched and irreplaceable. To restore the harbor is to restore this keystone species (Kulansky, 2008).

The Curriculum and Community Enterprise for Restoration Science (CCCERS) is a model to involve a significant percentage of New York City’s 1.1 million public school students in this process. The result will be to create an innovative STEM-C curriculum for teachers; a meaningful, highly engaging basis of learning for students; and a unifying platform around which to engage a diverse community of STEM-C professionals, graduate and postdoctoral scientists, and out-of-school time (OST) educators in carrying out an array of complementary education and restoration activities (Mueller, 2012). The process of keystone species restoration is necessarily multidisciplinary, hands-on, and scientific. In the case of oysters in New York Harbor—other regions, other species, other disciplines—the

undertaking requires the expertise of biologists, ecologists, engineers, oceanographers, and computer scientists working collaboratively in classroom, laboratory, and field settings. In the formal school and afterschool-based curriculum at the foundation of the CCERS project these diverse disciplines are anchored in strict core competencies of science and mathematics (http://www.nsf.gov/awardsearch/showAward?AWD_ID=1440869). One of the main focus of the project is also incorporating citizen science as an ongoing movement through large urban environments (Calabrese-Barton, 2012).

1.2 Research Plan and Goals

The three main research goals of the CCERS Project are: 1) Increase public middle school student access to high quality, engaging and authentic STEM-C learning in both formal and informal settings, thereby (a) increasing student STEM-C content knowledge; (b) improving student self-efficacy and confidence in STEM-C; and (c) presenting students with new role models from STEM-C related career fields.

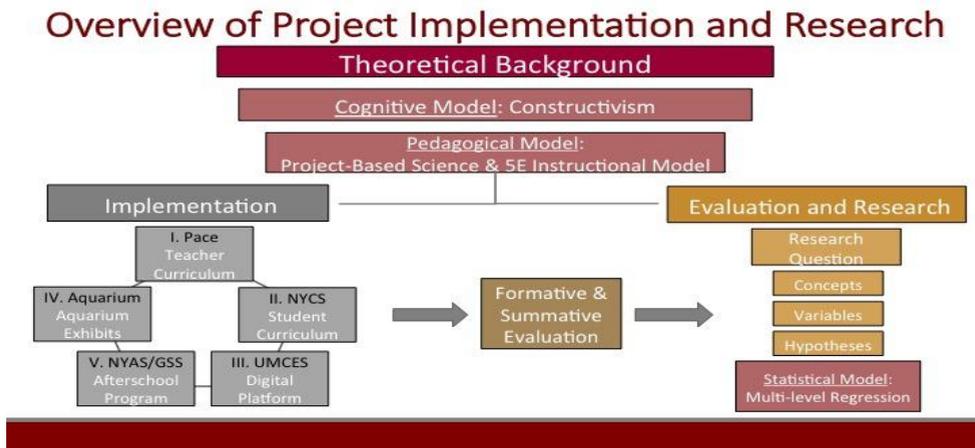


Figure 1.0 depicts a summary of the projects overall Research and Implementation Plan

Research Question & Outcome Variables

- Student knowledge and interest in science
- Educator pedagogical content knowledge and skills

Do the five programmatic pillars function **independently** and **collectively** as a system of interrelated STEM-C content delivery vehicles that are also efficacious in changing **student and educator disposition** toward STEM-C learning and environmental restoration and stewardship?

Figure 2.0 addresses the Research outcomes and variables

The following provides a brief summary of the CCERS research findings thus far on the project:

Goal 1 – The Educational Model: Increase the quality and effectiveness of STEM-C teaching and learning for middle school students of urban public schools.

- a. Assess the impact of teaching authentic field science using an integrated curriculum and community enterprise model.
- b. Develop an educational model that incorporates community-based restoration science into public school education that is scalable, replicable, and sustainable.

Goal 2 – Teachers: Increase knowledge and instructional skill of teachers, informal educators, and STEM-C professionals who work in economically disadvantaged neighborhoods.

- a. Increase educators' knowledge of STEM-C content
- b. Increase educators' knowledge and skill in teaching inquiry-based restoration-oriented lessons and activities
- c. Improve educators' frequency and perceived efficacy in the use technology, scientific equipment and project-generated data

Goal 3 - Students: Increase public middle school students' knowledge of and interest in STEM-C.

- a. Increase student STEM-C perceived content knowledge and skills.
- b. Improve student confidence in learning and applying STEM-C knowledge.
- c. Increase students' knowledge of and exposure to possible STEM-C career pathways.

Research Questions	Research Outcomes
<p>1. Do the five programmatic pillars function independently and collectively as a system of interrelated STEM-C content delivery vehicles that also effectively change student and educator disposition toward STEM-C learning and environmental restoration and stewardship?</p>	<ul style="list-style-type: none"> • Development of the Educational Model has been assessed through Social Network Analyses of survey and interview data illustrating growth in scale of interactions among and between pillars: <ul style="list-style-type: none"> ○ Integrated curriculum developed in Teacher Fellowship (Pillar 1) is being tested and refined by Cohorts 1 & 2 along with curriculum development experts from the New York Harbor Foundation (NYHF). ○ Lessons and activities using Bybee’s 5E structure are available to Cohorts 1 & 2 and others on the Digital Platform (Pillar 3) ○ Community enterprise collaboration between The New York Academy of Sciences (NYAS) and Good Shepherd Services (GSS) (Pillar 4) has produced, tested, refined, and implemented multiple lessons and activities for afterschool programs with uncertain resources. ○ Community-based restoration science is being conducted in field day activities (Pillar 2) and taught in hands-on field trips and class visits by The River Project (TRP) (Pillar 5). • Research team had implemented Project Sustainability Assessment Tool and reported on baseline and year-one progress to assess sustainability on a standardized instrument to enable project leaders to see growth and provide direction for further improvement. • Research team has provided answers in response to Principal Investigator (PI) inquiry regarding ideas for replicating project in other settings, with other species/settings requiring restoration to support project’s two-year extension.
<p>2. What comprises the "curriculum plus community enterprise" local model?</p>	<ul style="list-style-type: none"> • Cohort 1 & 2 (Pillar 1) teachers’ knowledge and instructional skill are increasing through fellowship and interactions: <ul style="list-style-type: none"> ○ Research team implemented Discussion Questions to assess teachers’ efficacy at baseline and end of year one. Qualitative responses will be compared to objective and quantitative data provided by evaluation team. • The New York Academy of Sciences & Good Shepherd Services (Pillar 4) have developed training program for mentors and are incorporating one another’s expertise to continuously improve lesson implementations and provide curriculum to greater numbers of students in afterschool/out-of-school settings. • The River Project conducts field trips with BOP-relevant hands-on-minds-on activities for students of teachers in Pillar 1 and in afterschool/out-of-school programs with Pillar 4.
<p>3. What are mechanisms for creating sustainability and scalability of the model locally during and beyond three-year implementation?</p>	<ul style="list-style-type: none"> • Project Sustainability Assessment indicates growth and progress between baseline and end of year one. Results will be discussed with or by leadership team. Research team will implement again for longitudinal comparison at end of year 2. • Scalability research via surveys and interviews to produce Social Network Analysis indicates that the project is achieving increasingly synergistic results within and between pillars. •

<p>4. What core aspects of the model are replicable?</p>	<ul style="list-style-type: none"> ● Pillar 1: The Teacher Training Fellowship at Pace University could be implemented with different cohort of urban middle school teachers to create curriculum in different city and/or for different restoration project. ● Pillar 2: Curriculum could be implemented with students at different schools, and/or revised to be suitable for different grade levels. ● Pillar 3: Structure is in place and could store new sets of lessons for new Pillar 1 & 2 partners. ● Pillar 3: Digital platform could expand to archive Pillar 4 lessons. ● Pillar 4: NYAS could provide lesson plans and training to other afterschool and/or out-of-school educators (e.g., Boys & Girls Clubs). ● Pillar 5: Other restoration sites and community partners could develop exhibits relevant to current project and/or new restoration science project.
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2. The Project Management and Organization

For organizational procedures the project has found it most useful to use *Smartsheets* for tracking progress and daily organization. Given the magnitude of this project, it is a necessary component. This enables all personnel to have an idea of what is taking place, where it is taking place and under what specific pillar. This enables all personnel to be immersed in the project at all times. It has proven to be very useful and beneficial. These charts also assist in the overall project management, design and facilitation and the deliverables and outcomes anticipated by the project.

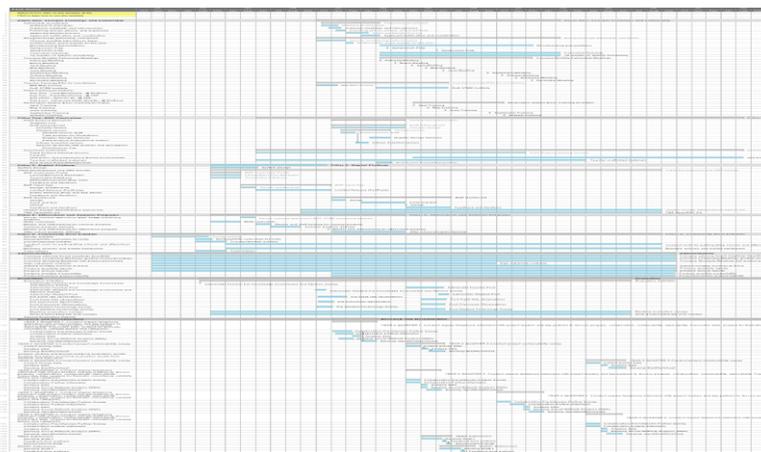


Figure 3.0 Sample CCERS Smartsheet Sample

3. Administrative Demands for Prime Institution

3.1 Finance, Legal, Budget, Administration, Office of Sponsored Research

Establishing procedures and protocols for the prime institution has been critical. There is a tremendous amount of paperwork, due diligence, contract review, budgeting and finance protocols that need to be implemented. Establishing realistic time frames, delivery of funding and reimbursements, sub-award agreement, contract reviews and following federal guidelines all must be considered, protocols designed and coordinated with each of the 10 partner institutions. This component of the work tends to be very time consuming so the tighter and more structured the protocols the more quickly that this will flow. An organizational chart was also established to assist with duties and responsibilities taken on by each of the institutions. (See Figure 4.0)

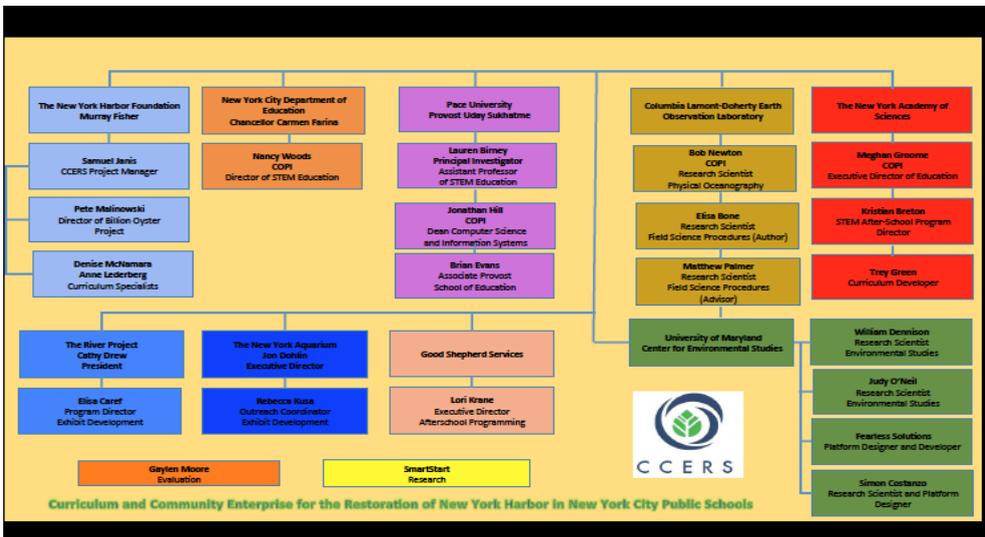


Figure 4.0 Multi Institutional Organizational Chart

4. Compelling Progress and Forward Movement

4.1 Environmental and Social Impacts

“The Environmental Restoration of New York Harbor through Curriculum and Community Enterprise” anticipated social impacts are listed below:

- Addressing the needs of the underserved diverse population of New York City
- Integration of Environmental Restoration, Citizen Science, and Project- Based Learning
- Creating clean water for New York Harbor; in alignment with the Clean Water Act
- Restoring New York Harbor with the Keystone Species of Oysters

- Creating opportunities for New York City students to participate in Citizen Science while restoring New York Harbor
- Allowing Public School Teachers to create meaningful curriculum for their students that allows them to have access to New York waterways while conducting Research
- Establishing a unique opportunity for teachers to work with Scientists and Science Educators to create an integrated project based learning curriculum for middle schools students
- Promote Growth in the STEM fields at an early age through unique middle school experiences

As the project continues to move forward, we anticipate expanding upon these aspects on a larger scale. Creating opportunities for students to participate in projects with a restoration focus allows for them to take ownership of their community and establish a sense of purpose within their community as well.

5. Capitalizing on Project Success

5.1 Product Design and Deliverables

The Curriculum and Community Enterprise for Restoration Science (CCERS) facilitates partnerships between scientists and middle school educators on ecological restoration and environmental monitoring projects. The educational model implemented at Pace University is designed to “wrap around” the student, including classroom instruction, field science, after-school programs and engagement with the student’s community. Its “pillars” include: a teacher training fellowship, student curriculum, a digital platform, afterschool and summer mentoring, and community exhibits. The digital platform includes a tablet app tailored to the project’s field protocols and linked to a database shared across schools and partnering institutions. Through the digital platform, data is integrated into a single citizen-science monitoring project, teachers share curriculum and best practices, and students can link directly to their peers in other schools. Curriculum development has been collaborative between scientists, science education specialists, and secondary school teachers. The CCERS is deeply rooted in project-based learning: the New York Harbor School has engaged high school students in environmental monitoring and oyster restoration in the Harbor for about the last decade. The science partners (University of Maryland and Columbia Lamont-Doherty Observatory) have been working with students and other citizen scientists in outdoor science over the last decade. Local partners in outside-the-classroom education include the New York Academy of Sciences, The River Project, which will provide field education services, and Good Shepherd Services, which provides after-school programming in schools serving primarily poor families. Scientists on the project engage directly with teachers and informal educators in curriculum development and citizen-science outreach. The New York Aquarium will host a permanent exhibit that depicts components of the project and the activities in the environmental restoration of New York Harbor.

6. Conclusion

The STEM-C Curriculum and Community Enterprise for New York Harbor Restoration in New York City Public Schools (STEM CCCERS), will make the Billion Oyster Project accessible to 40 or more additional schools, 80 teachers, and at least 8,640 students. The project consists of five distinct resource pillars that when combined in practice will foster direct collaboration between teachers and STEM-C professionals, innovative methods for teaching STEM-C in schools, complementary afterschool curriculum, and aquarium-based programming. Pillar One is the teacher training program at Pace University, engaging cohorts of 20 teachers in institutes for curriculum writing and field class methodology; monthly workshops for collaboratively evaluating and creating curriculum; monthly webinars led by STEM-C professionals for informing curriculum; and annual symposia for presentation of student research, teacher curriculum, and program results. Pillar Two is the in-school curriculum, consisting of an overarching Harbor-Estuary Literacy structure with fully developed modules and lesson plans in grade 7-8 Living Environment-aligned science (marine ecology, water chemistry, ocean engineering) and grade 7-8 Common Core aligned mathematics (linear equations, geometric functions, statistics, and computer programming) developed in advance by UMCES, CLDEO, NYHF, and Harbor School collaboratively. Field trips to waterfront oyster restoration sites for data collection and monitoring are also included. The third pillar, built by UMCES, is the BOP software platform, an online interface enabling students to create their own dashboards, upload, analyze, and compare local environmental data, and practice quantitative research; and enabling teachers and STEM-C professionals to share, critique, and store curriculum resources. Pillar Four is a full-scale estuary exhibit with accompanying educational programs created by local marine science facilities, NYA and TRP. Lastly, the fifth Pillar is the afterschool curriculum and fellowship, an expansion of NYAS's successful STEM mentoring program to 7 GSS afterschool sites using explicit STEM-C curriculum taught by scientists and high school apprentices.

The NSF STEM CCE Partners' extensive pedagogical experience and existing literature indicate that STEM-C teaching and learning is greatly enhanced when students practice authentic science inquiry, field research, and socially beneficial conservation, as opposed to learning exclusively in the classroom/lab without real-world context, physical engagement, or their own data (Altomonte, et.al, 2016). The project expands on previous research-based urban STEM-C enhancements by placing project and restoration-based experiences at the center of an integrated, field-to-classroom curriculum. This model validates that with appropriate application of technical infrastructure, intensive teacher training and holistic curricular scaffolding authentically inquiry-based, socially connected science learning can be main-streamed in the nation's largest urban school system (Hagay, G., & Baram-Tsabari, A., 2015). Significantly, mainstream, large-scale success is achieved by engaging

active STEM-C professionals, whose capacities are leveraged through appropriate professional development for in-service science faculty and appropriate use of digital technologies, professional networking and replicable field-based curriculum. The meta-data and evaluative instruments generated during the project will identify those characteristics of the curriculum that are essential to broadening its reach and linking curriculum in other school districts with local problems in restoration and sustainability.

The NSF funded STEM-C Community Enterprise is anticipated to be a fully scalable and transferable model, adaptable to American school districts. Leveraging our evaluative research and open-source technology platform, the program will be readily expanded to the additional 393 public middle schools in New York City at the completion of the project (Browne & Knowles, 2014). Ultimately, it is expected to be expandable to restoration, environmental research and sustainability projects in National and International communities, creating extremely broad impacts on mainstream science pedagogy. The program exclusively engages public schools in neighborhoods with persistent poverty and low socio-economic indicators (Boutte, et al., 2010). The STEM CCE-RS model demonstrates that physically engaged, field-based, authentic scientific research can overcome other systematic inequities to equalize learning for student groups currently under-represented in the STEM-C professions.

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Methodology of the comprehensive teacher training

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Abstract

Pedagogical tradition regarding musical education in Russia is one of the country culture achievements. Arrangement of quality musical pedagogy has been a matter of special importance within half a century history of music education system forming. Training of music teachers is particularly important in the field of music theory, as the comprehensive musician training is specific for Russian music education, where beside playing a music instrument he must possess knowledge from the music theory field, make sense of music pieces, understand and analyze them.

The conservatism in teaching traditions preservation began interfering with changing priorities of education. As a result, stagnation in the field of musical pedagogy outlined in the early XXI century. This has affected teaching music and theoretical subjects, which became heavy, boring, unpopular due to conservatism in teaching methods and focus on students motivation. As professional regards, there has been an imbalance in the ability to play the instrument, and the inability to navigate in the music literature.

Implementation of innovative approaches to teaching issues and appropriate teachers training became necessary solution to the problem.

The report considers innovations in teachers training traditions on example of the leading musical institution Moscow Tchaikovsky Conservatory.

Keywords: *pedagogical training of musicologists, comprehensive approach, innovative forms of training, multidisciplinary nature.*

1. Introduction

One of the main directions of teaching students at the Moscow P. I. Tchaikovsky Conservatory is the training of teaching staff. To date, certain traditions in the organization of future teacher training were developed. The preparation of the skilled staff is the most interesting in the historical and theoretical faculty, where not only future musicologists, journalists and lecturers are trained, but also teachers of different musical and theoretical subjects, without which the complete professional musician activity is not possible. It is about solfeggio, music theory, harmony, polyphony, musical analysis and literature. In this faculty, the best traditions of teachers training get logical addition in the form of a comprehensive methodology for pedagogical training of students, which allows to get highly professional teachers of musical and theoretical disciplines after graduation. The peculiarity of this training lies in the fact that graduates are not narrowly but widely professional staff, which competent in matters of teaching in schools and colleges. The multidisciplinary nature is the distinctive feature of students training at the present faculty.

To be noted that a conservatory being the higher stage in the system of professional music education was formed as the first one in Russia historically, thereafter due to reliance on the pre-university training lower stages such as music schools and profession-oriented school appeared. The institution trains teachers capable to preserve level and traditions of musical education in Russia for these stages.

2. The comprehensive approach in stages of students training

The guarantor of the quality training of future teachers is a multi-stage structure of the learning of teaching experience. Initially, it was simple and had two stages: a course of lectures on the methodology and teaching practice of teaching music theory courses. At the lectures in Methods, students had an opportunity to meet the specifics of a certain subject, find out the existing methods for its teaching, pedagogic traditions, educational and methodical literature for teaching a subject at different levels.

The second stage of teachers training is their direct practice, where the students have an opportunity to conduct lessons during the long period combined with the study. At this stage the students can teach different subject in any age group.

However, the demand for the third systematizing stage – the final qualification work, which could add up the readiness of a student to conduct quality lessons competent – arose in the course of time. The form, in which the idea of evaluation of pedagogical knowledge and skills of high school graduates embodied, was the defense of qualification work – methodological report on the problems of teaching a particular discipline.

After the successful mastering of all stages, a student is qualified as “Teacher of musical and theoretical subjects”.

3. Innovations, which came from the first stage of education

The best traditions of teaching are always carefully treated in training process of the Moscow Conservatory. Therefore, the one plan of subjects conduction was preserved. The lectures in Methods always remained lectures, and pedagogical practice had a format of lessons with a group of pupils. This conservatism had gradually brought to a standstill and some students training level degradation. The realities of the modern format with the inclusion of computer training and online resources dictated the need for new approaches in the field of the students pedagogy training. It must be admitted that in the field of music education at the professional level, a conservative approach to the introduction of modern multimedia technologies is due to the principle of motivation of those, who came to master the profession. Therefore, modern technologies are limited used in the disciplines of music.

Most of all the technological innovations in the field of music education affected the sphere of non-professional musical training (the so-called additional education), namely, children's music and art schools, where children and adolescents are engaged, who are unmotivated and who need to be interested in a long process of learning a musical instrument. The fact of free and long communication of modern children with gadgets was used by pedagogues at that stage of music education for implementation the gaming multimedia technologies into the learning process.

Paradoxically, but these examples were relevant for the modern teachers training. Therefore, the master-classes in the form of open lessons of invited skilled teachers from the lower stage of education have become the innovative form in the lectures course in Methods. The video presentations of such specialists clearly demonstrate the learning outcomes with the use of modern technologies. It is logically, that for the student getting acquainted with these technologies, the development of lessons by using multimedia becomes important, which they can defense after approbation in practice as the methodological work at the third stage of training – state qualification examination.

4. Innovations in expanding teacher training format

The updated principle of slant on the questions of teachers training relates also to going above mastering the traditional, classical disciplines. The modern musical and theoretical pedagogy introduced a range of new innovative disciplines, which are aimed at the comprehensive training of future musicians purposely combination of knowledge from different subjects for the more fundamental understanding of a music piece. In particular, such subject as Theory of music content becomes more popular. The author of this subject is the professor of the Moscow Conservatory V. N. Kholopova. This subject having arose in the system of the higher music education quiet quickly was adopted by teachers of the

primary stage of the music education. Its essence is to bring together all the knowledge obtained in different disciplines for a holistic analysis in order to understand a piece of music. As the number of specialists, who know this subject, is very small, our Conservatory fills this gap and provides an opportunity for students to practice in this discipline after previously listening of methodical lectures of the discipline author and hereafter defense the methodology project on the subject chosen within the frameworks of this discipline.

Listening to Music became another innovative subject, which had already arisen in the depths of primary music education. This subject has been coined by a teacher of children's music school N. V. Tsareva with the aim to teach children to listen, hear and understand music. As there are not so many specialists, who can teach this subject, the preparation of students to its teaching is provided. The author, who created this discipline, is invited for the methodological lecture with the video demonstration of lessons, as well as for the master class in the provided group of pupils, where student can see the methodology of subject teaching in real time.

All of these updates can significantly expand the boundaries of the modern teachers training enhancing their capabilities. In its turn this fact allows the conservatory to be sure that all of its graduates will be demanded and, consequently, employed after graduation

5. Innovative forms of student practice

One of important factors of the quality change of students qualification training is the possibility of multifold participation in the training process. First of all, it is about the activation of cognitive side of the issue. The format of preliminary preparation for the upcoming practice is now added to the previous forms of lectures of a specialist in teaching certain subject. It may be related to the student's own researches in the field of pedagogy, search and justified choice of modern teaching publications on various subjects. It can be a form of the project, the methodical elaboration of a particular discipline, its section or topic.

The game situations become one of the usual forms of work on the preliminary preparation for the practice in the course of lectures on methodology. Here, the students are given the task to imagine themselves as a teacher of a specific subject in a particular class (the role of which performs the rest of the students group). Next, the student has to project a certain situational scene.

The discussions of the open lessons conducted by the senior students finishing practice and obtaining an estimate for pedagogical practice have become an innovative form of pedagogical professional training. A great help in organization of such views and discussions is a specially created base in the Conservatory for practice of students, the music school with a ten-years course of study, which compounds two (primary pre-

professional and secondary professional) stages of education. The students, who are starting practice, have an opportunity to compare their impressions from the observed lesson with the opinion of other students and presenting heads of practical trainings.

6. Conclusions

The results of the comprehensive multifaceted approach to the issue of future teachers training speak for itself. Today, graduates of the historical and theoretical faculty join the ranks of teachers, not only of the central affiliated educational institutions: the world-famous Central Music School and the Academic Music College of the Moscow Conservatory, but also other musical educational institutions in the regions. The specificity of such teachers is their musical polyhistory and multidisciplinary training, skill of the competence approach to any format and the subject of the lesson.

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Teachers' perceptions about their practices: A qualitative research at the University of Padova

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Abstract

The aim of the paper is to present the results deriving from the qualitative analysis of open-ended questions included in the Prodid Project Questionnaire. Prodid (Teacher professional development and academic educational innovation) is a research project conducted in 2014-2015 at the University of Padova, which aimed at developing strategies to support academic teachers to enhance their teaching competences. The questions were formulated in order to collect teachers' points of view on excellence and innovation, perceived critical aspects in their teaching practice and the need for support to improve teaching. The analysis was conducted through the use of software Atlas.ti 7 in order to highlight, on the one hand the strengths and weaknesses of current teaching practices, and on the other hand, the need of support to improve teaching skills and enhance teachers' professionalism. Findings are presented by illustrating the distributions based on the different Schools in the universities as well as the thematic issues that emerged from teachers' answers. These results informed the professional development activities organized at the University for junior and senior staff in 2015.

Keywords: *higher education; teaching and learning; qualitative analysis; teachers' perceptions, staff professional development.*

1. Introduction

The paper is aimed at presenting the results that emerged from the qualitative analysis of open-ended questions collected through the questionnaire used in the research project "*Teacher professional development and academic educational innovation*" (Prodid).

The Prodid Project started at the University of Padova in 2014 with the aim of developing strategies to support academic teachers to enhance their teaching competences. One of the actions promoted by the Project concerned the exploration of teaching beliefs and practices through a structured questionnaire administered to all academic teachers in the institution.

The questionnaire (Dalla Zuanna et al., 2016) included a final section with three open-ended questions, aimed at exploring specific aspects of teaching, i.e. the *excellence and innovation* used by them in their teaching activity, the *critical aspects* encountered in daily practices and the type of *support* perceived as necessary for the improvement of the teaching process. 158 answers about excellence were collected, 468 about critical aspects and 371 support requests.

2. Method

Answers were transcribed and analysed with content analysis using Atlas.ti 7 by a team of researchers¹. Three hermeneutics units (one for each question) were created. After the coding phase, codes have been grouped into "families" (one for each question).

Families created referring to excellence and innovation are listed below:

1. University-community relationship
2. Teaching in English
3. Focus on students
4. Use of students' evaluations of teaching (SET)
5. Use of technologies
6. Teaching practices
7. Teacher's traits

¹ Following an inductive approach, the entire data set was read twice to ascertain that themes identified reflected the data and to code any additional data within themes that had been missed in earlier stages. All analysis were discussed within the whole research team (triangulation of investigators; Denzin, 1978).

8. Desires (18 answers): a family in which statements about teachers' desires have been included.

Critical aspects codes were grouped in 4 families:

1. Students' traits
2. Teacher's traits
3. Organizational aspects
4. Teaching evaluation.

Finally, *support* codes were grouped into 4 families:

1. University – community relationship
2. Human and financial resources
3. Contextual factors
4. Training/educational courses.

3. Results

3.1. Excellences and innovations

Table 1 describes the code families with the frequencies and percentages, while in Table 2, a distribution of answers on teaching excellences by School is presented.

<i>Excellences and Innovations</i>	N.	%	% (Teachers)
Teaching practices	67	48%	60%
Focus on students	23	16%	21%
Technologies	20	14%	18%
University-community relationship	12	9%	11%
Teacher traits	11	8%	10%
Teaching in English	4	3%	4%
Use of SETs	3	2%	3%
Total	140	100%	

Tab 1: Excellences and innovations. Families

School	
Agrarian and Veterinary Medicine	12%
Economy and Political Sciences	5%
Law	1%
Engineering	30%
Medicine	8%
Psychology	7%
Natural Sciences	12%
Humanities	25%

Tab.2 Excellences and innovations. Distribution by School

A common strength that emerged from the text seemed to be the use of *active* teaching practices: teachers affirmed that practices implying students' active participation (i.e. group works, laboratories, exercises, seminars, experimental designs, case studies, lessons by experts, problem based learning activities) were frequently used in order to enhance motivation and to foster a productive relationship between theory and practice.

Among excellence, teachers also mentioned their deep involvement in keeping alive the debate around the discipline. This was possible not only through an openness towards the scientific and professional world, but also by being committed to continuing education and professional development (*"In my lessons I invite experts from the field in order to establish a strong connection between what I teach and what they will find outside"*; *"my lessons start with a presentation of the results of a scientific research and this is the starting point for a collective discussion"*).

Another issue concerned teacher-student relationship. Teachers shared in their answers as excellence their attention towards some aspects such as: the involvement in lessons, respect, sharing educational objectives and assessment criteria at the beginning of the course, the possibility for some students to be part of group research projects, the attention towards individual students' differences, the search for challenging teaching styles and approaches in order to foster the development of higher order thinking skills (*"I pay attention to students and to my relationship with them, valuing their experiences and challenging them, motivating to their future"*).

3.2. Critical aspects

School	Students' traits	Teachers' traits	Organizational aspects	Teaching evaluation
Agrarian and Veterinary Medicine	37	4	60	2
Economy and Political Sciences	18	5	18	2
Law	9	0	8	3
Engineering	34	11	75	0
Medicine	15	5	36	0
Psicology	2	0	6	0
Natural Sciences	24	5	21	0
Humanities	23	0	45	0
Total	162	30	269	7

Table 3 Critical aspects. Distribution by School presents the distribution among School of critical aspects that emerged and difficulties highlighted by teachers.

Among critical aspects, all codes could be seen as obstacles for good teaching activity. For example, some students' traits such as lack of interest or of motivation or of prior knowledge, as well as "their heterogeneity in their previous education or in their skills" and irregular attendance were all considered critical aspects that made teaching in an appropriate manner difficult. Other perceived critical aspects were: a poor knowledge of English and passive participation during lessons ("always the same 4-5 students participate to the lesson, while most of the class is silent"). Moreover, the lack of technical support and of adequate time for preparing the course, as well as the inadequacy of some rooms, represented contextual and organizational factors that influenced the quality of teaching negatively.

Among teachers' traits, the answers concerned: a non- assertive communication style, low availability for students' needs, difficulties of linking disciplinary content with students' professional future activity, difficulties with bureaucracy, difficulty in keeping

alive students' interest towards the discipline, limited collaboration among colleagues, lack of professional development to learn and improve teaching competences.

In general, critical aspects concern more students and organizational issues than teachers themselves.

3.3. Support

As in previous paragraphs, in Table 4 the distribution of the answers by School is described.

School	University – community relationship	Human and financial resources	Contextual factors	Training
Agrarian and Veterinary	6	27	34	0
Economy and Political Sciences	3	17	22	2
Law	0	9	7	2
Engineering	5	20	47	27
Medicine	0	14	23	10
Psicology	0	8	7	0
Natural Sciences	0	5	22	2
Humanities	2	15	30	5
Total	16	115	192	48

Tab.4 Support requests. Distribution by School

Most of the support requests concerned the context (192 answers): more time to cover all aspects related to the discipline, improvement of online connections in the classrooms, reduction of number of the students, better use of virtual platforms, reduction of burocratic aspects, further exchanges with other Universities' colleagues, better coordination between courses, flexibility in the course timetables.

A specific aspect is related to the need of training courses on different topics such as: communication and public speaking, teaching practices and methodologies, strategies for authentic learning, technologies for blended and online teaching, methods for students' learning assessment.

4. Discussion and conclusions

In summary, the answers collected could contribute to exploring teachers' points of view about their teaching practices and specifically their perceptions about what works and what needs to be improved. Excellence seems a very complex construct. We could try to consider it as a *continuum*: for some teachers, it is very strictly linked to *internal* factors (classroom teaching methodologies, relationship with students) whilst for others, it is mostly connected to *external* factors (professional world, research). In the middle of this *continuum*, teachers could have a role of mediation between internal and external elements. These results are coherent with some frameworks of good teaching (i.e. Domenech, Descals, 2003; Parpala, Lindblom-Ylänne, 2007; Semeraro, 2006a, 2006b; Tigelaar et al., 2004) in which *personal* and *contextual* elements are always part of the map of aspects related to good teaching.

The answers on critical aspects and support requests were closely linked: in fact, as expected, support requests reflected the aspects identified as critical, trying to find a solution (for example, if teachers say that they feel they are insufficiently trained to teach, the support requested concerned the need for staff development programs on teaching skills).

A relevant issue that emerged concerned student learning assessment: very few teachers cited this aspect as an excellent dimension of their teaching practice. When it happened, the answers reported: sharing assessment criteria with students, intermediate assessments during the course, self-assessment procedures and peer-assessment practices. In agreement with recent literature about assessment, these are all components of a new assessment culture (Dochy et al., 1999; Kearney, 2013; Topping, 2003), in which assessment is considered as a tool for learning and as an opportunity for students to become responsible for their learning itself (Sambell et al., 2013).

The results of this qualitative research project have been used to inform the design of junior and senior staff development programs for academics in order to address real learning needs. The questionnaire, including the three open-ended questions described in this paper, has recently been administered in 7 Italian Universities with the same

aim of investigating excellence, critical aspects and needs for the improvement of academics in their teaching practices.

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Developing Communication Competencies Through E-Learning:

The Motivating Potential of Adaptive Video Role Play

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Abstract

To develop competence through e-learning tools, students must be motivated to use these tools. Hence, we conducted two empirical studies to explore the motivating potential of an adaptive video role playing game (AVR) for training communication competencies. In Study 1 (N = 54), we used a within-person design to examine students' motivation in three learning conditions: in the classroom, when playing the AVR, and when doing homework. The results showed that, relative to the homework condition, in the AVR condition students were higher in perceived competence, relatedness, intrinsic motivation, and flow. No difference between the classroom condition and the AVR condition were found. In Study 2 (N = 150), we used a randomized experimental design to examine the motivational consequences of using videos (AVR) rather than photos (APR) in the adaptive role playing game. We found that, relative to students in the APR condition, students in the AVR condition were higher in relatedness and flow. No differences in perceived competence, autonomy, and intrinsic motivation were observed. We conclude that an AVR may have considerable motivational benefits relative to common homework assignments, and some motivational benefits relative to an APR.

Keywords: *e-learning, video role play, games, motivation, flow*

1. Introduction

In a knowledge-intensive service economy, it is imperative that professionals possess excellent communication competencies. Indeed, employers and experts frequently assert that educational institutions should focus more on the development of these generic 21st century competencies (Dede, 2009; Silva, 2009; Voogt & Roblin, 2012). Such demands for more training in specific areas naturally create a dilemma for education programmes: how to find the time and resources within the existing curriculum? Developing communication competencies requires deliberate practicing (Ericsson, 2006). A common training method is role play training, which entails that students' rehearse communication scenario's, typically with the help of actors, and receive personal feedback from a skilled trainer. This is a labour-intensive and expensive form of education (Schönrock-Adema, 2002). Therefore, there is a need for smart solutions to increase students' deliberate practicing time at acceptable costs (Rotherham & Willingham, 2010). Online adaptive video role playing games (AVR) could potentially offer a solution. One example of such an application is the Communication Styles Game, developed by GITP. This is an online AVR that allows participants to practise a variety of communication styles in a simulated environment outside of classroom. For effective implementation of such an AVR in education, it is essential that students are motivated to spend many hours practising with the AVR independently. Hence, an important question is whether AVRs motivate students to learn. Although it is often assumed that the use of new technology in education can have a motivating effect (Prensky, 2001), there is very little empirical information available to support this. Therefore, we examined the motivating potential of the Communication Styles Game. In two complementary studies, we addressed the following questions: (1) What is the added value of the AVR, relative to more traditional forms of education: Do students perceive playing the Communication Styles Game as more motivating than receiving classroom instruction or doing common homework assignments? (2) What is the added value of using video technology with AVR: Do students perceive working with the video version of the Communication Styles Game as more motivating than working with the simplified photo version of the same game?

Below, we first explain the concepts AVR and motivation. We then present the results of the two studies. Finally, we present the discussion and recommendations.

1.1. Adaptive Video Role Play

In AVRs, players are placed in a simulated environment in which they control a character or avatar, while playing through a scenario in which problems need to be solved. Players need to use their knowledge and skills to determine which solution is appropriate. Depending on the player's behaviour in the game, he or she will perform better or worse in achieving certain goals (Feinstein, Mann & Corsun, 2002). In the AVR that was used in the present studies (i.e., the Communication Styles Game), the player takes on the role of project manager from a first person perspective. The task is to organise an event with a team of colleagues. The scenario is composed of a sequential series of video clips. After each clip, the player is presented with a choice of responses. Each response corresponds to one style from the communication styles model (Van der Horst, Hoogstraten, Meyer, Serlie, Wanrooy, 2010; cf., Merrill & Reid, 1981): *directive* (i.e., taking space, businesslike), *expressive* (i.e., taking space, personal), *cooperative* (i.e., giving space, personal), or *reflective* (i.e., giving space, businesslike). The aim of the game is to connect as closely as possible with the communication style of the conversation partners. The better the player performs in this regard, the more effectively the conversations proceed. After the game ends, the player receives information about the extent to which he or she has applied the various communication styles, and the extent to which he or she has succeeded in connecting with the conversation partners.

1.2. Motivation

Motivation refers to the cognitive factors and processes whereby goal-directed activities are instigated and sustained (Schunk, Meece & Pintrich, 2014). To gain insight into the motivating effect of the Communication Styles Game, we measured five variables that, according to self-determination theory (Ryan & Deci, 2000), and flow theory (Csikszentmihalyi, 1975), play an important role in individuals' motivation: (1) perceived competence, (2) autonomy, (3) relatedness, (4) intrinsic motivation, and (5) flow. *Perceived competence* refers to the degree to which individuals believe to be good at something. *Autonomy* refers to the degree to which individuals feel free to determine their own actions. *Relatedness* refers to the extent to which individuals experience satisfactory relationships with others. *Intrinsic motivation* entails that individuals engage in an activity because they derive pleasure and satisfaction from performing the activity. *Flow* refers to the state of immersion that individuals may experience when they are optimally motivated.

1.3. The Present research

In two empirical studies we explored the motivating potential of an online adaptive video role playing game (AVR): the Communication Styles Game. In Study 1 ($N = 54$), we used a within-person design to compare students' motivation in three learning conditions: in the classroom, when playing the AVR, and when doing common homework. In Study 2 ($n = 150$), we used a randomized experimental design to examine the motivational consequences of using video's rather than photo's in the role playing game. Because of the explorative nature of the studies, no a priori hypotheses were articulated.

2. Study 1: The Added Value of AVR in Education

The objective of study 1 was to gain insight into the motivating potential of the AVR, in comparison to classroom instruction and homework assignments.

2.1. Method Study 1

Participants. The participants in the study were 54 students of an university of applied sciences in the Netherlands who were following a course in communication skills that included classroom instruction, playing the AVR, and doing common homework assignments.

Procedure. Upon completion of the course, the participants filled in a short questionnaire in which they indicated their motivation in each condition (i.e., in the classroom, when playing the AVR, and when doing common homework).

Measures. Perceived competence, relatedness, autonomy, intrinsic motivation, and flow were measured using single questionnaire items. On a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), the participants indicated to which extend a statement applied to them (e.g., "While playing the Communication Styles Game I felt competent").

2.2. Results Study 1

The means and standard deviations of the five motivation variables, by learning condition are shown in Table 1. The results indicate a difference in participants' motivation across the three conditions. A multivariate analysis of variance with repeated measures (RM-MANOVA), with the learning condition as the independent variable and the five motivation variables as dependent variables, showed a significant overall effect, $F(2, 4) = 8.06$, $p < 0.01$, $\eta^2 = 0.13$. As indicated by the superscripts in Table 1, pairwise comparisons between the conditions indicated that the participants perceived playing the AVR as equally motivating as classroom instruction: no significant differences on any of the motivation variables were found. Further, for all five variables, the participants perceived classroom instruction as more motivating than homework assignments: we found significant differences in perceived competence, autonomy, relatedness, intrinsic motivation and flow. Furthermore, for four of the five variables, the students perceived playing the AVR as more motivating than homework assignments: we found significant differences in perceived competence, relatedness, intrinsic motivation and flow, but not in autonomy.

	Classroom (n = 54)		AVR (n = 54)		Homework (n = 54)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Perceived competence	4.19 ^a	1.48	4.26 ^a	1.48	3.83 ^b	1.50
Autonomy	3.93 ^a	1.64	3.68 ^{ab}	1.73	3.44 ^b	1.42
Relatedness	4.44 ^a	1.62	3.96 ^a	1.71	3.13 ^b	1.45
Intrinsic motivation	4.30 ^a	1.55	4.08 ^a	1.64	3.63 ^b	1.48
Flow	4.02 ^a	1.63	4.25 ^a	1.76	3.43 ^b	1.51

Table 1. Means and Standard Deviations on the Motivation Variables, by Learning Condition

Note. Within each row, different superscripts indicate significant condition differences at level $p < .05$

2.3. Conclusions Study 1

The results of Study 1 indicate that that the motivating power of the AVR was similar to that of the classroom instructions, but stronger than that of the common homework assignments. We therefore conclude that AVR may be of added value for education relative to common homework assignments.

3. Study 2: The Added Value of Video in Role Playing Games

A major drawback of AVRs is the relatively high costs of development. An interesting question is therefore, whether a similar effect can be achieved with simpler role-playing games, where scenarios are shown using photo's instead of videos. This would make it easier and cheaper for educational institutions to develop such games themselves. Therefore, we conducted a randomised experiment in which we contrasted the video version of the Communication Styles Game (AVR condition) with a photo version (APR condition) of the same game. In each condition we assessed participants motivation on the same five variables as in Study 1 (i.e., perceived competence, relatedness, autonomy, intrinsic motivation, and flow).

3.1. Method Study 2

Participants. The participants were 150 students of an university of applied sciences who volunteered to participate in the study.

Procedure. The participants were randomly assigned to the AVR or to the APR condition. In each condition, after playing the game, the participants filled in a questionnaire in which they indicated their motivation while playing the game.

Measures. Perceived competence, autonomy and relatedness were measured using the Basic Psychological Needs Scale (La Guardia, Ryan, Couchman & Deci, 2000). Response categories ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). Intrinsic motivation was measured on the Academic Motivation Scale (Vallerand, 1997). Flow was measured using the Flow Scale (Barzilai & Blau, 2014). Response categories ranged from 1 (*strongly disagree*) to 7 (*strongly agree*).

3.2. Results Study 2

The means and standard deviations on the five motivation variables, by type of role play game (i.e., AVR versus APR) are shown in Table 2. The results show a difference in motivation between the two conditions. A MANOVA with type of role play game as the independent variable and the five motivation variables as dependent variables yielded a significant *overall* effect, $F(5, 144) = 3.19, p < 0:01, \eta^2 = 0.10$. Post-hoc analyses showed that, relative to the participants who played the APR version of the game, the participants who played the AVR version of the game were higher in relatedness and flow. No differences in perceived competence, autonomy, and intrinsic motivation were found.

	AVR (n = 69)		APR (n = 81)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Perceived competence	3.72 ^a	.42	3.62 ^a	.52
Autonomy	3.18 ^a	.72	3.24 ^a	.78
Relatedness*	3.61 ^a	.61	3.34 ^b	.72
Intrinsic motivation	4.44 ^a	1.02	4.67 ^a	1.09
Flow*	4.74 ^a	1.08	4.27 ^b	1.46

Table 2. Means and Standard Deviations on the Motivation Variables, by Type of Role Playing Game

Note. Within each row, different superscripts indicate significant condition differences at level $p < .05$

3.3. Conclusions Study 2

The results of Study 2 indicate that the motivating power of the video version (AVR) of the online adaptive role playing game is higher, relative to the photo version (APR) of the same game. However, the differences concern only two of the five motivation variables. We therefore conclude that using videos rather than photos in online adaptive role play games may have some added value.

4. Discussion and recommendations

First, based on our research, we conclude that AVRs such as the Communication Styles Game can motivate students to learn. The motivating effect of the Communication Styles Game is similar to that of classroom instructions but higher than that of homework assignments. It is therefore plausible that AVRs could be successfully employed as a blended learning tool, to increase the deliberate practicing time of students outside classroom instruction. A note is the relatively low number of participants ($N = 54$) in Study 1, which may limit the generalizability of our findings. However, our conclusions are in line with previous research suggesting that e-learning tools should preferably be used to supplement rather than to substitute regular instruction (Liao, 1998; Tamim, Bernard, Borokhovski, Abrami & Schmid, 2011).

Second, we conclude that the use of videos in role play games (AVR) provides some added value when compared to using photos (APR). Because we used a randomized experimental design, we are confident that the differences in motivation are caused by the use of video rather than photos. These findings are in line with research indicating that media-rich learning materials are typically more effective relative to media-poor learning materials

(Mayer, 1989; Liu, Liao & Pratt, 2009). It is important to note, however, that we only found significant differences on two of the five motivation variables. Given the considerably lower development costs of photo role-playing games (APR), it may therefore still be worth considering the use APRs in education. More research is desirable in this regard. Education needs affordable and effective tools that can encourage students to spend more time and energy developing their competences. Online adaptive role playing games may contribute to this aim. In particular, when used as a supplement to common homework assignments.

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The New Function of the Student Leisure in Russian Education

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Abstract

The aim of our research is to study the dynamics of the influence that students' leisure practices in Sverdlovsk region have on the formation of modern students' values. The object of the empirical analysis is music and theatre as forms of multi-faceted socio-cultural influence. With regard to the interdependence of the two forms and resorting to concrete empirical evidence, the authors demonstrate a change in the importance of students' leisure within the context of modern Russian education, as well as the emergence of a new function of leisure, which consists in the formation of general cultural competences and world views of future professionals. The paper emphasizes the role and the importance of student leisure practices for society and hence, a necessity of their thorough study with the aim to develop a consistent cultural policy. The authors cite the results of their monitoring sessions, which reveal leisure preferences, notions and beliefs of modern students in higher educational establishments of Sverdlovsk region; the findings also dismiss the myth about a low demand for world and national classical works. As concerns the conscious choice of artworks, students reveal an increased level of reflection in those of them that aim to rectify the ills of society. The student becomes the actor of society, which is also reflected in his/her leisure preferences. As concerns the formation of societal values, the student is changing the role of the driven for the role of the driver, and the prefigurative model of socialization comes into play.

Keywords: *modernization of education, students, values system, leisure, general cultural competences, youth policy*

1. Introduction

The multidimensional process of modernization in today's Russia attracts attention to the process of modernization in higher education, which is the major communicator of culture and a tool for intergenerational continuity. In Soviet times the social institution of education was built upon the responsibility of the main actors of the system itself, which was legally secured. According to Regulations of Ministry of Higher and Specialized Secondary Education in the USSR, which were in effect in 1968-1988 (before the fall of the Soviet Union), this central agency is immediately responsible for 'the state and further development of higher and specialized secondary education, as well as for the quality of education given to specialists'[7. Art. 1]. This institutional rule secured the world-famous quality of Soviet education, which was and still is understood as a synthesis of education and upbringing. Organizing leisure was an integral part of students' upbringing. The results of education in Soviet era were validated in two unequal documents: the basic diploma of higher education and a personal characteristic, which was institutionally important.

The social transformations of the 1990s-early 2000s, the inclusion of Russia into the Bologna Process led to global and contradictory changes in the concept of educational activity. This resulted in changing the rules of interaction between the state, social communities and groups, involved in higher education. The main institutional postulate on the national level was the process of performing social functions per se, as compared to the responsibility for the outcome of the process. This is legally secured in the Regulations about the Ministry of Education and Science, 'which carries out the function of developing and realizing the state policy and legal regulation in the sphere of education, scientific and technological activities, innovative activities... as well as in the sphere of education and upbringing, tuition and guardianship of underage citizens, in the sphere of social support of students and pupils of educational establishments and the youth policy...' [6. Art. 1] Such goal-setting generally complies with the notion of the educational system in Europe.

We believe that the consequences of changing institutional rules for higher educational establishments have an ambivalent character. For instance, the understanding of the role of education in reality has shifted from a social service to a commercial one; it has transformed to suit the needs of selling the service of education and training to the social partners interested in it – to students, and to a certain extent, to their parents. Practice shows that the process of education can be commercialized to a greater degree than the process of training, since the former possesses more properties for validation. That is, a certificate of higher education (now the only paper to certify your education after graduation) allows the employer to conclude what professional competences the bearer has. This certificate cannot reflect how well the graduate has learnt the norms and values of their social and professional group. As it turns out, the post-Soviet system of values does not require any

form of validating these competences, which is why the processes of upbringing have been in low demand in present-day higher education.

The closing stage of the transfer to the Bologna system of education proved to be contradictory. Two aspects are noteworthy. On the one hand, education for a young person today is an aim, a tool, a means and a must for successful socialization. The terminal significance of education and professionalism (the primary indicator of higher education) has decreased greatly. For instance, among the students of Sverdlovsk region in 2012 education took 9th place in the ranking of 17 different positions and was marked only by 16% of all respondents [8, p. 160], and in 2016 it took 8th place, as marked only by 16% of all respondents¹. On the other hand, ‘the strategic aim of the university is to form general cultural competences (those reflecting world views and the system of values) and general professional competences’ [5, p. 200]. On the one hand, the top priority in the education policy has been given to the competency building approach, which stands for the process of forming a complex of general cultural and professional competences in the future specialist, which will enable him/her to fully integrate into society, into the professional sphere and any professional teams. On the other hand, the educational activity as a system of forming world views of a highly-qualified specialist (i.e. forming general cultural competencies) was excluded from the list of indicators, which is used during accreditation. As a visible result, many Universities cleared the position of Provost for Educational Work, and consequently, reduced leisure programmes for students.

The specifics of youth culture within the context of stable social systems reveal itself in a critical attitude towards traditional values of the older generation. In times of radical change the transformational processes of values systems in youth culture are followed by a conscious rejection of traditional values and an exchange of the traditional for their own - often opposing - values. These can normally be traced in students’ behavioral patterns, lexis used, and leisure practices.

The leisure patterns of the youth today cannot be described as unambiguous. Against the background of deepening societal stratification, growing social differentiation of the youth, commercialization of culture, the differences between rich, intense leisure patterns in one group of young people and poor, routine time-spending in another are becoming more and more evident. Some have diverse leisure patterns, some can be described as spiritually impoverished, and yet others do not reveal any recognizable patterns of leisure [8, p. 296]. These claims are supported by the sociological research of recent years. A study of cultural needs and peculiarities is of major significance for developing the concept of state youth policy in higher education.

¹ The first three positions in values system of the students of this decade are occupied by a. health; b. family and children; c. money, material gain, starting their own businesses.

Over the years of monitoring Sverdlovsk students (1995 – 2016), the problems of organization and content of leisure have lost their place and dropped closer to the bottom in the ranking of acute social problems that trouble students most of all (see: 8, p. 290–315).

Still, we should not underestimate the low status of students' leisure problems. It is doubtless that against the background of material need, anxiety over possible unemployment, personal and social insecurity and other burning issues of the same kind, leisure and its patterns retreat into the shade. At the same time, leisure is a way to master cultural values; it is one of the most important spheres of self-realization and self-assertion for a young person; it is a source of psychological stability. This holds true for all students – not only those from Russia. A similar conclusion was made by a group of researchers who studied theatre as a leisure pattern among American students [see: 1; 2]. It is noteworthy that the problems that bothered the American students in this case, were similar to those experienced by our students. Among these problems are the following: a lack of information sources about the possibilities for planning one's leisure and hence, low information awareness about concrete projects in the sphere of leisure, scantiness of electronic content (musical notation, multimedia, audio recordings). We believe that these issues are more intensely felt by American students because of the highly commercialized nature of the media sphere in the USA and stricter limitations on author's rights. However, this claim needs additional comparative analysis for further use.

A lack of any concept of governing students' leisure gives rise to different asocial behavioral patterns – not only to 'classical' alcoholism, drug abuse, violence, etc. Of a much greater risk is the usage of student groups as protest groups for political aims. In this sense students constitute a risk group to a certain degree.

2. Methodology and results of the study

The monitoring of leisure preferences among students of the Middle Urals is a part of a complex study, which was started in 1995 in conjunction with a sociological research of societal transformations in Russian society [See: 9.]. Since those times musical preferences of students have served as a reliable indicator: the variant 'listening to music' consistently comes first in the ranking of all students' leisure preferences.

The first stage of the study was conducted in 2005–2006 among students of the biggest higher educational establishments in the region (Ural State University and Ural State Technical University), which were united into Ural Federal University (UrFU) in 2010. The study aimed at finding a correlation between preferences for classical and mass music in its simpler forms. The experimental part of the study included broadcasting musical pieces of different genres and directions. On the managerial level the experiment was agreed upon as

a musical project in a higher educational establishment. Then a social survey was conducted using representative sampling. The results of the survey brought us to certain conclusions about a discrepancy between cognitive and conative aspects of perceiving music among students (see: [4]). Those of them who did not have any musical education verbally denied any possible need of listening to classical music, while the experimental part of the study disproved the fact - the overwhelming majority of all respondents (73%) were willing to listen to and purchase the music they heard.

The second stage of the study (2007) confirmed the hypothesis about the positive perception of the music suggested during the realization of the project.

At the next stage of our study (2008–2009) we obtained analogous results on the basis of experimental research carried out in branches of higher educational establishments. The study debunked the myth about a low demand of higher forms of art, which by itself presents a great danger from a strategic point of view. It poses certain risks for the cultural level of society, for the social mandate, since all the prior experience and the level of involvement of the consumer into the product itself are very important variables, which affect the demand. A significant reduction in cultural samples leads to absence of any demand in the long run. The respondents voted for the significance of classical art by the majority of votes, classical art being an inseparable constituent of an individual, as well as for the importance of spiritual development in the formation of students' preferences.

On the 4th stage of the study of leisure patterns (2010 – 2011) we researched students' preferences in the sphere of theatrical art. Its influence on students can hardly be overestimated, since the world outlook is shaped on the emotional and rational-intellectual levels. We conducted a study called 'Students of UrFU and Modern Theatre' by quota sampling. The results testify to the fact that most of the students show uneven patterns of frequenting the theatre. Despite this, most respondents expressed a wish to visit the establishment more often. It is interesting to note that two-thirds of those interviewed considered it an absolute must to include theatre-going into the official curriculum in a higher educational establishment. When making their choice of a play, students were mainly guided by the title, the actors, the director, reviews and articles on the performance. The respondents preferred modern repertoire alongside with classical performances, but they only approved of the former if the play did not distort the original script. Almost 80% of those interviewed believed that any cultured person should be a theatre-goer. As concerns the question of who should be financing culture, the state and sponsors received the majority of votes. More than a half of the respondents agreed that the state does not pay sufficient attention to culture.

The fifth stage of the study based on comparable methods was conducted in 2016. There are three basic issues to be mentioned in this respect. Firstly, musical comedy was one of

the most sought-after forms of entertainment among students, which was proven by observing students who visited the same performances of different theatres. Students initiated such outings by themselves through their social environment. We believe that this can be connected with how students perceive the topicality of theatrical repertoire and the level of actors' performance and talent. In spite of its name, this type of theatre can boast a significant number of world and national classical plays of acute social kind in its repertoire.

Secondly, the survey, showed a high level of demand for the classical theatre: 62% of all respondents are positive towards modern interpretations of classical works if the original does not undergo significant change.

Thirdly, the top positions in the ranking of students' preferences were taken by complex performances covering a variety of multifaceted topics, which included general questions of philosophy as well as conventional national problems, which make the audience analyze the present-day Russian reality. This is 'Katherine the Great', a play about the Russian State (premiered 2008, 'Golden Mask'), 'Silicone Fool', a play about the information society (premiered 2007), 'A Night of Open Doors', a play based on Dickens' novels (premiered 2004).

Thus, we can state that students make a transfer from the driven to the driver in the formation of values in society, and the prefigurative model of socialization comes into play [see: 3].

The modern student, as compared to 'the Soviet student', has gained independence in everything that concerns organizing leisure environment. He/she is not suppressed by a 'poor organization of extracurricular activity in a higher educational establishment'. As a representational survey among students of higher educational establishments in Sverdlovsk region in 2016 shows, this was cited as a reason for dissatisfaction only by 5% of respondents. The major limiting factor today is insufficient personal funds, cited by 46% of the students, and a lack of spare time, cited by 40%: of them. The latter, however, is paradoxical, since the results of the same survey reveal a good reserve of free time: every third student has 2-3 hours a day, 30% of them have from 3 to 6 hours daily, and every 10th respondent can spare more than 6 hours on leisure every day.

Besides, our study of students' leisure patterns confirmed the need for traditional forms of leisure, which promote the formation of traditional values. Students reveal a latent need for worthwhile samples of culture, which is not satisfied within the modern context of higher education.

This choice testifies to the fact that students themselves choose those leisure patterns that were earlier in active use in the educational activity of the higher educational establishment.

Thereby leisure again acquires the function of forming general cultural competences of the student, albeit in a form reduced during the process of modernizing higher education. If Russian universities are limited in their capacity to solve the financial problems of all students, they can certainly resolve managerial issues with time. We believe that bringing back the management of students' leisure patterns as an element of the educational process can realize this very important role of higher education.

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What should students learn in the digital world?

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Abstract

The rapid changes in the working environment and society as a whole as a result of digitalisation demands a new and changed competence profile. Specialist requirements are changing, and extracurricular requirements are of growing significance. Curriculum development at higher education institutions should take note of this change in order to ensure that higher education graduates are ready for professional life, and to reinforce personal development in the digital world. What should students learn in the digital world? This question invites us to consider further, from a digital perspective, the competency orientation in higher education. This article will demonstrate approaches to competency-oriented curriculum development, to consider the digital transformation in skills profiles and to render this process more dynamic. This article is based on experiences at a higher education institution that has encountered the challenges of digital transformation.

Keywords: *competency orientation, digitalisation, curriculum development, learning for employment*

1. Digital transformation – transformation of curricula?

“Digitalisation is the transformation of society and the professional world as a result of current progress in information and communication technology” (Kreulich & Dellmann 2016, p. 11). Many times digitalisation is considered in teaching by using digital teaching methods. Often the choice of the medium comes first, followed by looking for the appropriate didactic concept. In our framework we start with the didactic concept beginning with the question how necessary competences are influenced by digitalisation.

The global data pool has exploded as a result of digitalisation and networking. In order for a person to properly evaluate and utilise this immense volume of data, they must first understand it. In the professional, industrial world (Industry 4.0), this does not simply refer to, say, the ability to understand how devices and facilities operate, but also the ability to select and apply suitable sensor and measurement technology in order to access the useful data. For example, the digital flood of data increasingly requires all members of our society to be able to select and filter data in an appropriate manner. The current debate regarding “fake news” (Shellenbarger 2016) is a clear representation of this. Accordingly, our increasingly digital society and professional world also demand new and transformed competence profiles, including in the curricula of courses at higher education institutions. This is especially true when one considers that current and prospective students possess increasingly different skills profiles. “The group of so-called “digital natives” is appearing, with new and different expectations of a higher education institution” (Kreulich & Dellmann 2016, p. 10).

While the professional world and society as a whole have seen rapid transformation as a result of digitalisation and networking, the curriculum development at higher education institutions has instead been decidedly sluggish (Jenert 2016, p. 122). Alongside the requirement for new and transformed competence profiles in courses of study, the process of curriculum development should also be transformed in order to make courses’ requirements more up-to-date and in order to (better) meet the needs of future generations of students. As a potential answer to this, this article will present a strategy in three phases that we are currently trialling at our higher education institution: taking competency orientation seriously, reconsidering competency orientation from a digital perspective, and making curriculum development more agile.

2. Taking competency orientation seriously

In the European Higher Education Area, the concept of competency orientation in study and teaching is – formally, at least – extensively considered and implemented (Schaper 2012, p. 6). “The competency-oriented design of courses of study, classes and testing is a central requirement of the European Academic Reforms” (HRK Nexus, n. y.). Newly-developed courses of study must be designed in a competency-oriented manner, and the various levels of higher education qualification defined using indicative skills targets.

However, “only in a few cases has it been possible to adequately implement the didactic requirements associated with competency orientation” (Schaper 2012, p. 6). That is hardly surprising, and an orientation towards ‘learning outcomes’ and the accompanying focus on skills acquisition by students necessitates a demanding change in teaching and learning culture (a shift from teaching to learning). The teacher imparting knowledge is no longer at the forefront, and this is instead replaced by the acquisition or further development of competencies by the students themselves: higher education graduates should be able to exhibit effective and adequate processes to solve both everyday and professional problems and situations. They should be able to translate knowledge into actions (and thereby avoid inert knowledge), which thus constitutes increased requirements on the didactic and methodical structure of teaching and examinations in order to stimulate, support and accompany the development of the students’ skills.

In order to meet the demands on competency orientation in a practical manner and produce a coherent blend of learning outcomes, teaching and learning processes and different forms of examination, the concept of Constructive Alignment (Biggs & Tang 2011) has gained currency in higher education institutions. Based on the formulation of competencies as a result of the student learning process (learning outcomes), adequate teaching and learning formats and forms of testing can be derived. This process is highly demanding, as teachers with differing methods must first agree on common learning outcomes, realise the value of extracurricular skills, and subsequently draw conclusions for the structure of their teaching and testing – something which does not simply mean abandoning the “beaten track” and additional work.

To support this, so-called ‘curriculum workshops’ have been established. They are a communication forum in which a project group – ideally composed of all parties including course leaders, academic deans, teachers, student and external representatives, amongst others – comes together and appreciates the development of courses of study as a joint effort (Harth 2015, p. 39). Integrating external moderation, consultancy, assistance and above all didactic stimulation – by the higher education institution’s internal Centre for Quality Development or similar – can significantly support this process. The external expertise can also include an open, methodical approach (e.g. the design-thinking method),

to support in differentiating between various competence levels or to reflect on interim results.

Case examples from actual course development in curriculum workshops show that this method can lead to agreement on common learning outcomes in a course of study, and can lead to recognition of the considerable significance of extracurricular skills. Harth et. al. (2017) reports the successful operationalisation of the qualification goal of “building, operating and dismantling life-cycle oriented structures” in a curriculum-workshop with structural engineers. Academic skills and interdisciplinary competences were prioritised in the discourse. “In this process, for example, all participants were particularly aware of the considerable significance of target-group specific communication skills regarding local politicians, administration, legal professionals and developers. These experiences and others like them led the participants to the ‘aha moment’, which makes the content of this arduous formulation process worthwhile, qualitatively develops the course of studies, allows teaching to demonstrate the direct and methodical application of theory, and does not simply meet formal requirements in the form of a ‘formulaic prose” (Harth et.al. 2017, p. 18). However, taking competency orientation seriously not only means a logical focus on learning outcomes, but also taking into consideration the students’ various competence levels on beginning the course of study. In both directions, it is worthwhile considering the concept of competency orientation and the effects of the digitalisation.

3. Rethinking (digital) competency orientation

The changed skills amongst current generations of students and school pupils on starting a course of study is particularly prevalent in the USA. A proponent of this idea is author Marc Prensky, who was the first to introduce the term “digital natives” to the debate, and who currently writes about “extended minds” in relation to young people’s easy access to smartphones. “These new devices allow kids not only to *take in* information (as they could with reading) and create reports (as they could writing), but to combine, analyze, and manipulate information in very new ways“ (Prensky 2016, p. 14). It is perfectly clear that the availability and reach of digital media now enables access to new bodies of knowledge, other forms of communication and above all a completely different communication behaviour. Competency orientation at higher education institutions should consider the influence of the digital world not only with regard to communication and (digital) media skills and in connection with critical and sensitive handling of data, but should instead take all spheres of competence into consideration. In an initial step, Kreulich & Dellmann have highlighted three characteristic displacements as a result of digitalisation in each of the extracurricular skills areas of methodical, personal and social competences (Kreulich & Dellmann 2016, p. 21-52). For example, in the context of a higher education institution, the decision-making ability derived from the greater freedom of choice in the world of digital consumerism, and the generally free-of-charge take-back obligation in the case of a wrong

decision, translate into students' behaviour when making decisions on compulsory modules or in examinations. The binding nature of decisions and their consequences – similar in nature to those in future professional life – must often be learnt from scratch (*ibid.*, p. 28).

As a principle, for each course of study it is useful to identify skill areas that are reducing in significance as such activities will be better conducted digitally in future. Above all, this concerns repetitive routine work. On the other hand, focus should be given to skill areas that are of greater significance due to the influence of digitalisation and the resulting requirements of society and the professional world. Surveys show that personal and social competencies are of increased significance as a result of digitalisation (Stifterverband 2016). The Director of the Centre for E-Business at the Massachusetts Institute of Technology (MIT) emphasised the need to promote teamwork, creativity and social skills in particular (Brynjolfsson 2016).

The joint research of higher education teachers from a range of disciplines into the influence of digitalisation on skills changes is the subject of workshops both within and beyond our institution. These workshops firstly consider the obvious academic changes and the evident shift in terms of communication skills towards multitasking abilities, or the ability to deal with the current overload of data and information (ability to focus). In addition, however, they also consider the relevant changes to extracurricular skills due to the influence of digitalisation, which only become evident on closer inspection. Then, by way of example, specialist courses particularly affected by the digital transformation (logistics, building automation) are considered. At the same time, digital teaching formats (e.g. a health skills lab, live classroom for social work courses) are examined more closely for their potential in terms of skills acquisition in the digital world. The aims of this collegial exchange are:

- to make teachers more aware of the transformation effected by digitalisation,
- to make good practice transparent in all areas of higher education,
- to identify further training needs,
- to generate conclusions to apply to curriculum development and the didactic and methodical structure of teaching, and
- to adapt higher education infrastructure (e.g. library facilities, lecture hall design) to serve changed competence requirements.

Three central dimensions can be derived from this discursive process:

3.1 New competence areas

When considering the effects of digitalisation on students' academic profiles, the change from specific to generalist competences has been particularly evident to date. This can be illustrated with an example from our university: In the field of building technology in architecture studies, the ability to precisely calculate heating requirements or correctly calculate radiator dimensions will be less important, as computer programmes will soon be able to calculate these figures quickly, precisely and easily by entering known parameters. Instead, prospective architects must demonstrate themselves to be generalists, with an overarching understanding of energy concepts. In order to work professionally as an architect, the ability to bring together numerous influencing factors (such as light, air and warmth) to create an integrated energy analysis is increasingly important. Digital tools such as databases or computer simulations can again prove helpful in developing this generalist skills profile.

Integrating digital media into teaching provides increased awareness of transfer competence. Digital simulations of professional situations must be reviewed in hindsight, to examine the extent to which they are realistic. For example, students in the nursing care skills lab at our university work with an interactive dummy, but without the environmental conditions often encountered in practice such as overcrowded rooms and insufficient staffing. The transfer of skills into reality must not be forgotten in the learning process. Both of these examples can be used to illustrate that the skills profile in module descriptions should be heightened as a result of digitalisation, and that consequent changes are required in the teaching and testing process. This also applies for competency shifts.

3.2 Altered skills profiles

In the digital world, the ability to work in a team is shifting towards inter-culturally sensitive, written collaboration skills from remote locations. At the same time, problem solving abilities are regularly shifting towards intelligent usage of the various team resources in the global, virtual space. Problem solving processes in higher education learning should therefore be developed collaboratively, and analogous to the virtual team process. The potential ability to digitally store the learning process presents a particular opportunity. Students can, for example, be filmed in simulations of professional situations or during laboratory experiments, in order to collectively analyse and reflect upon the learning process, rather than simply regarding the learning outcome as the result of summative testing. The skills acquisition process therefore becomes (more) transparent, and presents the opportunity to practice analytical and reflective skills. The final issue in terms of a skills shift is underlined by responsibility when dealing with digital data, with the aim of digital self-determination. How are private and public spheres shifting, and how can we set limits on these? How responsibly do I act in the digital world?

3.3 Relocation of skills

Digitalisation often entails acceleration processes and (all too) immediate solutions. For example, students in the fields of design, architecture or engineering turn all too quickly to a wide range of computer programmes for planning, designing and construction. The programme then defines the operational framework. However, the structured actions in the planning, construction or designing processes end up overlapping, or often turn out to be too short. The response to this deficit is the conscious deceleration of the learning process, a return to an analogue space and a focus on basic competencies. Before the digital tools are applied, students should be taught skills on how to generate ideas with a pencil and paper, skills for evaluating, estimating and calculating key construction parameters should be strengthened, and focus should be placed on basic research when planning. In terms of curriculum development, when designing a module, care should be taken to ensure that sufficient time is designated for developing basic skills.

4. Making curriculum development more agile

This insight into new, altered and relocated competency profiles emphasises the need to rethink higher education curricula in the digitalised world. To determine what students should learn today, skills changes must be identified, these changes anchored in modules and actively integrated into teaching and testing. Moreover, making higher education curricula more practically relevant to the digital world is a more pressing issue than ever. A look at vocational training can be helpful in this regard. The aims of achieving professional skills are manifested in the organisation of professional teaching in learning fields rather than in teaching subjects. These learning fields are oriented towards professional realities (Riedl 2011). In the learning field for mechanics, for example, there are 60 teaching hours dedicated to physically overhauling a gearbox, as opposed to purely academic content such as gearbox technology, materials science or manufacturing technology. In this theoretical concept, the transformational dynamic of digitalisation can be followed and considered (even if this is generally not integrated or attempted in school practice). In educational discourse in the USA, the new digital possibilities have led to discussions of the need to focus on “real-world problems” in education processes (Prensky 2016, p. 3), and of “educating a generation of solutionaries” (Weil 2016).

At our higher education institution, enhancing the practical relevance of teaching is also an attempt to make curriculum development more agile. Based on the agile Scrum software development method (e.g. Goll & Hommel 2015), an agile curriculum development process was created at our Institute for Technical Business Management. In their ‘Digitalisation’ module, future business administrators are given the task of conducting interviews with different kinds of Managers in order to identify current and specific skills requirements in their professional field. The results of the interviews (supplemented data from with further

research) are compared with the course profile. The purpose of this is not only to make students aware of current skills requirements, but also to react appropriately by modifying the module during the course of study. This pilot scheme was supported and recognised by the Association for the Promotion of Humanities and Sciences in Germany in funding scheme Curriculum 4.0 as one of nine projects across Germany in 2016.

5. Summary

The competency orientation and the associated outcome orientation makes higher education institutions aware of what students should learn. In our view, this outcome orientation must be further considered in the digital world. Due to the influence of digitalisation and networking, skills profiles are undergoing such fundamental transformations that curriculum development should react more quickly. This does not necessarily require an agile curriculum. Nonetheless, a central strategic task for higher education institutions is defined herein. Perhaps the insight into our strategic process can act as stimulation for other higher education institutions. In our strategy, we began with curriculum development, which evidently must – and which will – be continued with systematic adaptation of teaching and studies and of the infrastructural framework.

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University Teachers' Perceptions about Assessment Practices: A Study in Five Portuguese Universities.

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Abstract

This paper looks at how Portuguese university teachers look at assessment in Higher Education. It focuses on their perspectives about assessment in higher education after the implementation of the Bologna Process, the connection between assessment, teaching and learning process and the selection of criteria and methods of assessment. Data were collected through face-to-face interviews and online open-ended questionnaires in five Portuguese Public Universities in different fields of knowledge. In total, 57 teachers participated in this study. Findings are presented according the categories emerging from the data. Issues of change in assessment practices, the connection between teaching, learning and assessment as well as difficulties to assessing students' work are analysed. Implications of the findings are discussed.

Keywords: *Bologna Process; assessment; higher education; teachers' perceptions.*

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1. Introduction

The Bologna Process in Europe has brought about changes in the role of the teacher and the student, in teaching and learning processes and in curriculum and assessment in Higher Education. Within this new framework students are supposed to play a pivotal role in their learning process. The principle underpinning this paradigm shift is, amongst other features, the transition from a system based on the mere transmission of knowledge towards a system based on learning and training, one in which developing both technical and soft skills are of paramount importance (Decree-Law nº 107/2008). This paradigm shift implies that “the learning process is not just or primarily about transfer and restitution of knowledge, but about deeper understanding and critical thinking. The implication for learners is that they are not defined as recipients of a service or customers but rather as active participants with shared responsibility for outcomes” (Sursock & Smidt, 2010, p. 32). This requires more active teaching practices and new forms of assessment which are supposed to be more student-centred (Webber & Tschepikow, 2013). However, many university teachers face a number of challenges which influence the process of assessment, such as the class size, fewer staff, lack of time, pressures from departments for research and publications (Biggs, 2003), the speed of lectures (Light & Cox, 2003) and fewer resources with implications for assessment practices. The aim of this study was to analyse Portuguese university teachers' perceptions about the assessment process after the implementation of the Bologna Process. This study also sought to contribute to better understand the reality of the Portuguese higher education contexts, particularly, after the Bologna Process.

2. Assumptions of assessment after the implementation of the Bologna Process

In most European countries, changes occurred in teaching, learning and assessment process with the implementation of the Bologna Process (Flores et al., 2015; Pereira et al., 2016). In addition to the Bologna Declaration (1999), the Leuven/Louvain-la-Neuve Communiqué (2009) stresses the promotion of a learner-centred learning approach in order to develop students' competences for the real life. This assumption was further reaffirmed by the Bucharest Communiqué (2012) and Yerevan Communiqué (2015) suggesting the use of a learner-centred approach through innovative methods that promote students' participation and the development of critical skills. However, these changes do not occur in a standard form due to different paces of the Bologna process in European countries (Furlong, 2005; Pereira et al., 2016), leading to “different attitudes and responses of academics” (Sin, 2012, p. 401). In the Portuguese higher education landscape, the paradigm shift begins to be outlined in Decree Law no. 42/2005 which presupposes that “The student should have an active and central role in his/her learning process regarding contact hours, which can take different forms and methods of teaching, or in assessment, which will included all activities

related to assessment such as contact hours, projects, individual study, field work, etc. Regarding assessment there may be different methods of student assessment such as oral and written essays, examinations, tests, theses, reports on internships, and fieldwork with continuous assessment, etc.”. Subsequently, the Decree-Law 107/2008 expresses the obligation of higher education institutions to report the progresses made in relation to the change of the educational paradigm. These changes had led to implications for the assessment process. In this regard The European Association for Quality Assurance in Higher Education (2009) established a set of guidelines emphasising that students should be assessed based on appropriated purposes of formative and summative assessment, through a clear explanation of the assessment methodology, particularly the criteria for marking. The skills’ development other than technical skills was also highlighted with the implementation of the Bologna Process. However, earlier literature found that not all of the assessment methods allow the development of such skills (Tuning, 2007). Within this framework a learner-centred assessment emerged as more suitable to meet the Bologna agenda. A learner centred-assessment approach emphasises the student as the centre of the process promoting the active knowledge construction (Webber, 2012). This approach is based on the use of different methods and modes of assessment such as project, portfolio, self-and peer assessment, simulations, amongst others (Flores et al., 2015) which enable the development of skills such as autonomy, collaborative work and critical thinking (Sambell & McDowell, 1998), promoting feedback and the students’ motivation (Huba & Freed, 2000). Nevertheless, research is needed on changes of educational practices as a result of the Bologna Process (Wihlborg & Teelken, 2014) and on students’ and teachers’ perceptions and practices of assessment and learning (Pereira et al., 2016). This study has sought to contribute to understand assessment in higher education, particularly, assessment practices and their relationship with teaching and learning, after the implementation of the so-called Bologna process in the Portuguese context.

3. Method

This study aims to answer to the following research questions:

1. Have the university teachers changed their assessment practices after the implementation of the Bologna Process? If so, in which ways?
2. What are the main difficulties they face in the assessment process?
3. How do they relate assessment methods to the teaching and learning process?
4. How do they select criteria and assessment methods?

3.1. Participants

The participants in this study are university teachers teaching year 3 students in 5 Portuguese Public Universities. In total 57 teachers participated in the study; 53% are male and 47% are female teachers. Their age ranged between 30 and 68 years old. Most of them (58%) are Assistant Professors and the years of teaching experience in Higher Education (HE) ranged between 2 and 44 years. Most of them have 29 years of teaching. Out of 57 teachers 32 teach in Social Sciences and Humanities, 10 in Life and Health Sciences, 9 in Natural and Environmental Sciences and 6 in Sciences and Engineering. Out of the 57 teachers 24 were face-to-face interviewed and 33 teachers responded to the questions using the link provided via email. In this study the four scientific fields of research identified at the Portuguese Foundation for Science and Technology were used: Social Sciences and Humanities (SSH), Life and Health Sciences (LHS), Natural and Environmental Sciences (NES) and Sciences and Engineering (SE). Different programmes were selected in each field: SSH: (Educational Sciences, Basic Education, Economics and Law); LHS: (Nursing, Medicine, Pharmacy); NES: (Biology, Geology) and SE: (Mechanical Engineering, Computers Engineering, Biochemistry).

3.2. Data collection and analysis

Interviews were conducted with university teachers in five Public Universities. Face to face interviews and responses via email were received in 10 out of the 14 programmes selected. The participants were identified in the different departments in each programme. The interview protocol was designed to obtain data on the following dimensions: changes in assessing student learning after the implementation of the Bologna Process; difficulties associated with assessment in Higher Education (HE), connections between assessment and teaching and learning process and improvements to be made in assessment in HE. The main purpose was to get to know if assessment practices have changed and why. Data were collected between October 2012 and June 2013 in 5 Portuguese Public Universities. Interviews were transcribed verbatim. Content analysis was used to identify emerging categories, enabling a systematic description through the categorisation of data.

4. Findings

Findings are presented according to the emerging categories arising from the data analysis. In this study, the following themes will be explored: perceptions about assessment in HE as part of the Bologna Process; perceptions on assessment and its connection with teaching and learning process; practices and modes for selecting criteria and methods of assessment; and perceptions and experiences regarding assessment practices.

According to some of the participants' accounts, their assessment practices have changed after the implementation Bologna Process. They claim that they have changed their assessment practices in order to improve the connection between learning and students' future working context, the development of soft skills and the promotion of continuous assessment and feedback in order to better engage students in their learning process. Furthermore, some teachers who have not changed their assessment practices claimed that they have started teaching when the Bologna Process was already in place and others claimed that the programmes in which they taught were already designed according to the assumptions and principles of the Bologna Process.

But most of the participating university teachers coming from the Social Sciences and Humanities state that they have not changed their assessment practices because they already used the so-called learner-centred methods before the Bologna Process had been implemented, which is in sharp contrast to participants' perspectives coming from other areas of knowledge (LHS, NES and SE). They also claimed that they were already concerned with continuous and formative assessment, with the use of practical work inside and outside the classroom, and with systematic and collaborative work from the part of the students. On the other hand, all SE teachers, for example, changed their assessment practices. However, university teachers also state that a number of problems still remain, namely the lack of time to perform all tasks required of them and the top-down imposition to change assessment practices according to Bologna principles. They are sceptical about the effects of the changes in real assessment practice. It is also important to note that difficulties related to the large number of students per class, the shortage in faculty members, the lack of time and availability for teachers to engage in teaching and assessment due to the pressures to engage in more research and to get their work published are also identified by the participants. Issues of fairness and subjectivity inherent to the assessment process also emerged from their accounts. These and other aspects are responsible for the frequent use of more traditional practices rather than innovative and learner-centred methods.

This study also found that the improvements to be made in the assessment process in higher education are similar to the difficulties pointed out by teachers in the assessment process. However, issues related to the connection between the university and the context of work,

the integration of assessment and learning, plagiarism and lack of maturity of the students were also aspects in need of improvement in the assessment process in HE. Findings from the study suggest that participants recognise that the assessment methods they put into practice strongly influence the teaching and learning process. In particular, they highlight the promotion (or lack of it) of students' participation and engagement in the activities in the classroom, the emphasis on the outcomes and the lack of valorisation of formative assessment and the role of feedback. In other words, students' participation and perceptions about assessment influence their engagement in the learning process.

Furthermore, assessment also influenced the teaching process. Participants of this study claim that they had to change their teaching practices according to assessment methods used. One of the reasons identified by the teachers is the need to adapt teaching methods to the students' choices of the assessment practices. However, teachers refer that there was no negotiation of assessment methodology with the students. Findings also show that the adequacy and content mastery are clearly the criteria most valued by the teachers. The attendance and participation in classes and the development of soft skills such as communication skills, critical skills and writing skills were also identified by the teachers. The setting up of criteria is related to the assessment methods used, and consequently there are skills that only can be developed using given assessment methods. Not all of the assessment methods enable the development of soft skills such as learning to think, work collaboratively, communication skills and critical thinking. The participants claim that when students perform a test what is most valued is the scientific knowledge; however when assessed by other assessment methods, such as practical reports, in addition to scientific knowledge, writing and group work skills are also valued. Also, it was found that teachers selected the assessment methods and the criteria based on learning goals, and the characteristics and learning outcomes of the programmes. This may indicate that the curricular design of each programme may influence the assessment methods to be used and the selected criteria. Therefore, curriculum design may guide, albeit not explicitly, teachers' actions regarding the choices of methods and assessment criteria. Teachers emphasise the importance of assessment in integrating both technical skills and soft skills, as these enable the connection with reality and the future professional life. The kinds of assessment that can stimulate students to apply knowledge in contexts and real situations is framed with a learner-centred assessment perspective. In teachers' view, assessment methods such as practical work, problem solving and projects along with continuous assessment are best suited to this purpose. Teachers claim they use self and peer assessment as these modes of assessment have advantages such as: promoting autonomy, critical thinking, self-regulated learning, fairness, enabling the students to recognise their successes and failures and those of their colleagues. They also recognise that these methods support the students in the assessment process. However, some disadvantages were also highlighted by participants such as: subjectivity, unfairness and the fact that the students were not coherent when

giving grades to themselves and to their colleagues. Thus, issues such as peer and self-assessment need further attention as well as the nature and form of feedback to be used by both the teacher and the students.

5. Conclusion

Findings from this study point to some conclusions. First, although teachers claim that there have been changes in assessment practices after the Bologna Process in their accounts it is possible to perceive that the practices they consider to be the most suitable to the Bologna principles are not those sometimes those they actually use. This is due to lack of conditions and a number of constraints that currently exist in higher education with regard to the assessment process, such as large classes, the semester structure, the organisation of working time and lack of availability of teachers for pedagogical issues. Teachers appreciate the characteristics of an assessment centred on the learner, as it allows the development of key skills for the professional world. However, the difficulties in assessing do not allow them to use these methods as they would like to. The same happens concerning continuous assessment through feedback. Even when the changes in the assessment practices are imposed by some universities, teachers are reluctant to use them because of these constraints. So, improvements are required by the participants in the assessment process in higher education in order to allow the use of assessment practices that they consider more appropriate to improve learning and more suitable to higher education purposes. Consequently, there are some tensions between what they want to do and what they can do in the light of the conditions that they face. This study also suggests that assessment influences the teaching and learning process. Through assessment, or depending on the assessment method used, learning and teaching is developed in different ways. Motivation and students' performance, self-regulation of learning and the nature of the skills to be developed are related to the assessment methods used. More needs to be done in this field, particularly in regard to students' and teachers' perceptions of assessment after the implementation of the Bologna Process in different European countries and research on the effectiveness of the learner-centred methods in terms of student learning in different fields of knowledge.

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Innovative Food Systems Teaching and Learning: overcoming disciplinary and teaching silos to fix the food system

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Abstract

While inter-university and interdisciplinary research projects are very common in Higher Education (HE), inter-university and interdisciplinary teaching programmes are still very rare. This paper reflects on the first year of the Innovative Food Systems Teaching and Learning (IFSTAL) programme. IFSTAL is a three-year project funded by the Higher Education Funding Council for England (HEFCE) with the aim of bringing together postgraduate students from very different programmes to learn about food and farming beyond their own disciplines. IFSTAL creates learning environments and activities that encourage students to think systemically about the transdisciplinary challenges facing the food system. IFSTAL combines both face to face events and an inter-university virtual learning environment (VLE) that was created from scratch for this project. At the end of its first year, a survey was carried out to evaluate the programme and inform the structure for year two (Y2). Survey data revealed students preferred interacting at face to face events over the shared VLE. The programme for Y2 was re-designed to incorporate more flipped classroom features with an andragogy-based approach.

Keywords: *inter-university; flipped classroom; interdisciplinary teaching; virtual learning environment; postgraduate.*

1. Introduction: Background information and the structure of the original IFSTAL programme

IFSTAL is a three-year HEFCE-funded programme across seven English HE institutions to foster interdisciplinary opportunities amongst postgraduate students studying food-related degrees. The consortium started running in September 2015 and is led by Oxford University. The other members are City University of London, Reading University, Warwick University and the Leverhulme Centre for Integrative Research on Agriculture and Health (LCIRAH) - itself a consortium of three institutions: the London School of Hygiene and Tropical Medicine (LSHTM), the School of Oriental and African Studies (SOAS) and the Royal Veterinary College (RVC).

IFSTAL has been designed to offer participants a new holistic framework to think about the food system. This free and voluntary programme is open to any postgraduate students from any subject (both Masters and PhD) at the seven participating institutions. Inter-university research projects are common in HE in United Kingdom, but not so inter-university teaching across programmes and disciplines, which is what makes IFSTAL unique. IFSTAL recognises that the complex challenges facing the food system in the XXI century, such as climate change, food poverty, loss of biodiversity and soil, water risks, diet-related diseases, etc., are not disciplinary challenges, but crosscutting ones that require a wide range of disciplines to unpack them, and more importantly, tackle them. IFSTAL introduces students to system thinking approaches to encourage them to think beyond the methods and problem-understanding perspectives of their own disciplines; the programme also fosters interactions between participants and workplace partners both at events and through a diverse range of internships. The objective is to allow students to consider real life challenges they might encounter in their research and workplaces (Ajates Gonzalez and Wells, 2016).

Designing a voluntary programme for such a diverse cohort composed of students at different levels of their postgraduate education (master and PhD), from a wide range of disciplines and potentially joining at any time of the academic year was a complex challenge. The approach taken was based on a combination of teaching theories aligned with the use of learning technologies as a way of overcoming the barriers that running a programme across seven different HEs entails. The programme offers students different levels of engagement through a diversity of channels: face to face events of varying lengths and formats (short sessions, lectures, away days and an annual summer school), and online (live-streamed events, VLE, social media channels and e-newsletters), as well as dissertation placements and post-graduation internships. This blended learning approach was adopted to provide a variety of options to a large and diverse IFSTAL cohort and meet different learning styles, content preference and time availability. A blended learning model

was considered appropriate, as it has been used before to promote interdisciplinary teaching and learning within higher education contexts (Cooner, 2011).

A variety of collaborating platforms and learning technologies are part of the day to day running of IFSTAL for both the team and the students who are based in different cities and distant sites. Interaction across the IFSTAL partners is possible thanks to the ongoing collaboration of a dedicated team of educational technologists and education coordinators who created a brand new Virtual Learning Environment (VLE) shared across all seven institutions. Using Moodle as the underlying platform, the IFSTAL VLE supports fora, teaching materials and quizzes amongst other functionalities such as live chat rooms. Students interested in joining IFSTAL can self-enrol through their institutional VLE. When they enter the VLE, they are counted as having joined the programme. Interested members of staff across the partner institutions also have access to the VLE. Year one of the project implemented the design included in the original proposal to HEFCE based on a core series of eight lectures webcast live across each of the institutions and also live-streamed to facilitate participation to distant students based abroad or unable to attend in person. The live-streaming aspect was a learning curve and different technologies were tested, including Webex and Adobe Connect. Materials and activities related to the lecture series were uploaded to the VLE around the time of each event to offer a parallel and linked online learning journey.

In terms of teaching theories, due to the relatively recent novelty of food studies and food policy and their multidisciplinary character (Lang et al., 2009), the number of papers and books on the subject are still very limited but informative and innovative (Hilimire et al., 2014). The growing realisation by academics, civil society and policy makers of the interconnections amongst public health, nutrition, agriculture and environmental sustainability is giving way to an increasing interest in food; this popularity is also starting meta-thinking debates on how to best teach the complexity of cross-cutting and multidisciplinary food issues. Several scholars have written about the political elements intrinsic in the teaching of food studies (Francis et al., 2013) and the need to co-produce knowledge with other actors in the food system in order to achieve sustainability (e.g. recognising traditional knowledge of farmers) (Ison, 1990; Francis et al., 2013). IFSTAL encourages students to seek different perspectives, not just the loudest or dominant ones, and to study interconnections and push-pulls in the food system (Lang et al., 2009). This paper discusses the structure of the programme in year one and selected results of a survey to participants designed to collect data on their opinion about the different learning methods and channels used by IFSTAL. The last section of the paper discusses how these results were used to inform the new structure of the programme in Y2.

2. Methodology

As part of the IFSTAL programme, a yearly survey is to be conducted of the participants. Other evaluation methods such as feedback forms after events and VLE metrics were also used to assess the success of the first iteration of the programme. Given the large size of the cohort, an online survey was considered however to be the most effective method to seek feedback in a consistent and efficient manner (Fricker and Schonlau, 2002). The first survey took place over May and June 2016 to evaluate students' experience of the initial year of the programme. Ethical approval was sought for the survey across all the participant institutions.

The survey questions were co-designed with educational coordinators at each of the affiliated institutions and a survey expert from the RVC team. The creation stages included meetings and a peer-review process as well as requesting a small sample of students to test the pilot survey using a likert scale. The questionnaire was composed of 23 questions structured in three sections: the past, present and future. The section on the past presented questions regarding students' views before joining IFSTAL, (e.g. motivations to join the programme). The present included questions regarding their current type and level of engagement with IFSTAL (what channels they valued the most). Finally, the section on the future focussed on asking students what other activities they would like to see taking place in IFSTAL Y2 in order to get their insights and empower them to act as co-designers and able to change the content and structure of the programme.

Taking advantage of RVC's business account, Survey Monkey was selected as the most convenient and appropriate platform to administer the survey. The invitation to complete the online survey was sent to all IFSTAL members via email communication. At the time the survey went live, 341 students had registered on the IFSTAL VLE and thus considered IFSTAL participants. Of that overall cohort, a smaller core of approximately 150 students was more actively engaged and regularly attending IFSTAL events. A response rate of one third of the cohort (115) was set as a target. A total of 57 students took part in the survey. Although the target was not reached, the response rate was considered positive as it represented an excellent proportion of the core cohort of highly engaged students who attended IFSTAL events regularly. The breakdown of respondents per institution was as follows: Warwick University (14), Reading University (13), City University of London (11), Oxford University (7) and LCIRAH (6) of which, London School of Hygiene and Tropical Medicine (2), Royal Veterinary College (2) and School of Oriental and African Studies (2). Six respondents preferred not to disclose their institution. The main limitation of this study is that it does not include an analysis of inter-factor relationships. Further research could include a deeper analysis of survey results and qualitative data from interviews with students.

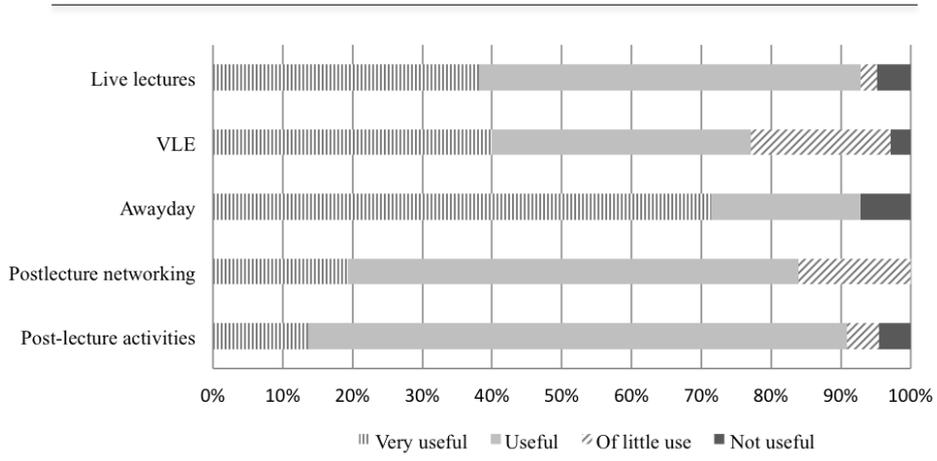
The next section discusses the main results from the survey and how the insights collected were used to inform the re-design of the programme for its second iteration.

3. Discussion and conclusions: Integrating results into 2016/17 programme

Due to space constraints, the summary of responses to two questions only is included in this paper (Table 1 and Table 2). Those two questions were selected for their relevance to the overall structure of the IFSTAL programme and the focus of this paper, but insights from other questions in the survey are also briefly discussed.

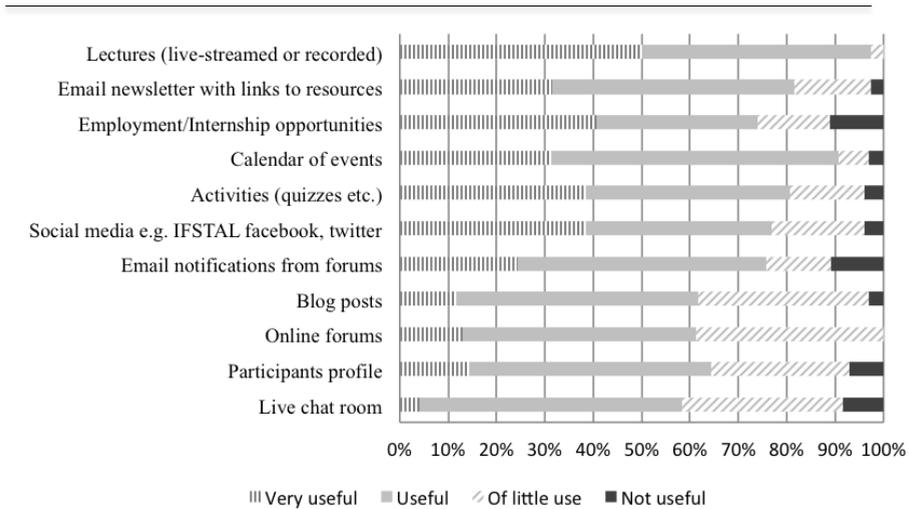
Overall, IFSTAL face to face activities were rated as “very useful” or “useful” by over 80% of respondents (Table 1). This seems to reflect how students value different ways of engaging with the IFSTAL community. The results indicated that students have a preference for interacting face to face over the VLE. The Away Day (the longest face to face activity carried out at the time the survey was administered since the first summer school that run for six days did not take place until July 2016) was by far the most valued activity. 26% of respondents reported finding the VLE not very user-friendly and difficult to log in, navigate and interact with others, while 58% thought it was easy to very easy. It was a surprise to the IFSTAL team how participants’ profiles on the VLE were not considered as “very useful” by more students (c.15%), given the fact they were designed to find peers in partners’ institution sharing similar research interests. It would be interesting to carry out interviews with respondents to explore the reasons for this lack of engagement with profiles.

Table 1. Summary of responses to Q11: How useful did you find the following aspects of IFSTAL?



Source: IFSTAL Survey (2016)

Table 2. Summary of responses to Q17: How useful did have you found the online resources on the VLE (IFSTAL online learning platform)?



Source: IFSTAL Survey (2016)

The voluntary character of the programme means the activities and content have to be engaging and balanced in terms of the time and effort required from students as some worry IFSTAL might clash with their paid programmes. While students really value the face-to-face activities, it is difficult to foster engagement on the VLE since most of the theory and advice on increasing students' online participation and engagement on technology-enabled programmes focus on grading online participation as part of the grade policy (Deng and Tavares, 2013). An example of this point is when students are asked to post comments on a forum and reply to a couple of colleagues' comments in order to be awarded a certain percentage of their final mark on the module. IFSTAL is not able to play with the mark award as it is not an assessed programme. On the other hand, the voluntary aspect of the programme means that IFSTAL does not encounter restrictions from a regulatory body or from narrow assessment rules, allowing greater flexibility and room for experimentation.

Structural gamification strategies (Kapp et al., 2014) could be used further to motivate students, as IFSTAL is a non-credit bearing programme independent from their assessed programmes. With this in mind, more quizzes have been introduced in Y2 for students to self-assess their learning. However, some authors have recently shared their concerns about the use of gamification strategies such as badges, as they reward quantity over quality (Burt, 2016). Students also raised issues around lack of clarity about their progression and learning journey. Taking into account this point and students' preference for face to face activities, a flipped classroom approach was introduced in the Y2 programme (Berrett, 2012). The former lecture series was replaced by four online units released through the academic term. Materials and videos were made available online. Each unit was linked to a more interactive face to face workshop where students could apply their learning, ask questions and interact with peers and staff. Clearer programme objectives were prepared for Y2 alongside more specific student requirements listing what minimum level of engagement was expected from them. The VLE was redesigned to improve students' experience of their IFSTAL learning, including a more streamlined front page and content presented in smaller chunks (units), to allow greater flexibility.

More Away Days were planned for Y2 and the first ones were brought forward to the beginning of the academic year to offer students the opportunity to meet early and foster a sense of community, hopefully making students feel more at ease when contributing to the VLE. A student-only forum was created to offer students a protected and more private space, as some reported feeling intimidated by knowing over 300 users, including academics, would read their posts. The IFSTAL VLE offers students the chance to reflect more on how their contributions might be received by others with different views, which can foster deeper learning; the VLE also brings different IFSTAL participants together across sites, time and space (Siemens, 2004). Finally, another aspect of pedagogic theory relevant to IFSTAL is adult-learning theory or andragogy (Knowles, 1984). IFSTAL's

diverse cohort is characterised for having a high proportion of mature and professional students. When designing activities, the use of the interdisciplinary character of the subject of study fostering multiple perspectives is a key lever to engage students and connect to their prior knowledge and professional experience (Lattuca et al. 2004). IFSTAL must continue to offer students a menu of activities and annotated reading lists so that students are able to deep in into the subject according to their wishes, time and previous experience, thus becoming proactive actors in stretching their own zone of proximal development (Vygotsky, 1978; Kilgore, 1999). This is also an attempt to encouraging the development of a responsible and independent approach to learning.

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Embedding Information Rights into Higher Education in the UK

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Abstract

Estimates suggest that a data breach costs an organisation over \$4 million and that the total global cost of breaches will soon exceed \$2 trillion. Hacking is part of the problem but errors in processing by individuals are still the most reported reasons for data breaches in the UK. With predictions of more jobs involving data processing in the future and the exponential growth in accessible personal data, it is increasingly important that this problem is taken more seriously.

This Information Commissioner's Office (ICO) sponsored research constitutes stage one of a study into the teaching of Information Rights (IR) in HE across the UK including depth interviews with professional bodies and Pro Vice-Chancellors, and an online survey aimed at Heads of Departments.

Though not widespread, the research found instances of IR being taught but some barriers to embedding it across relevant subjects do exist, including:

- *tutor expertise;*
- *development and consistency of materials; and*
- *competing curriculum development drivers.*

Most respondents recognised the increasing importance of IR and welcomed ICO support with this but also felt that to improve the situation buy-in would be more likely if it was part of overall management strategy.

Keywords: *information rights; ICO; teaching; data breach; data protection.*

1. Background and Context

A 2016 global study by the Ponemon Institute (2016) found the average cost of a data breach to an organisation is increasing yearly; the latest calculations showed an increase of 5% surpassing \$4 million. In a press release promoting their research entitled “The Future of Cybercrime & Security: Financial and Corporate Threats & Mitigation”, Juniper Research (cited by Smith 2015) estimates that “the rapid digitisation of consumers’ lives and enterprise records” will cause the cost of global data breaches to exceed \$2 trillion by 2019; up four-fold on estimated costs in 2015. Whilst hacking by skilled cybercriminals is credited by them with much of the damage done, errors in processing by individuals are still one of the most reported reasons for data breaches in the UK according to the regulatory body, the Information Commissioner’s Office (ICO). The latest data published (December 2016) by the ICO show a total of 453 incidents reported (Q2 only). Of these, only 53 were classed as “Cyber incidents” and 88 as “Other principle 7 failure”, which comprise those security incidents that do not easily fit into the other categories (see Figure 1.). The other 312 incidents were due to some form of human error or inadequate action.

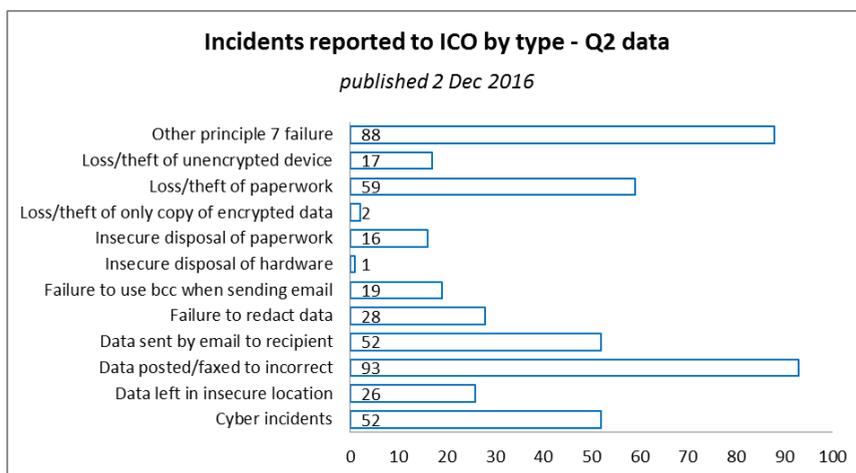


Figure 1. Q2 Incident Types Reported to ICO. Source: Adapted from data published on ICO website (2016).

There are significant changes on the horizon to data protection legislation in the EU, including a substantial increase of up to £20 million or 4% of global turnover in the penalties that can be imposed on offending organisations. Whilst much of the new legislation will seem familiar to anyone conversant with current EU laws, there is a fundamental shift in the underlying principle away from what many see as a tickbox attitude to compliance towards one of accountability, where organisations will be required to prove that all foreseeable risks were mitigated against prior to any breach occurring.

As the world embraces SMART technologies and the Internet of Things, the amount of personal data being produced and processed continues to increase at a phenomenal pace. According to the World Economic Forum (WEF) (2015) the “fourth industrial revolution”, brought about by the convergence of technologies such as 3D, artificial intelligence, machine learning, nanotech and biotech advances, will have a highly disruptive effect on jobs and skills in the next decade (see Figure 2.). As well as predicting a greater reliance on a highly educated population to fill the roles these new technologies will create, in its “Future of Jobs Survey” the WEF also reports concerns over ethical and privacy issues as the key driver of change for 16% of the companies taking part in the research with many companies changing its processes to stay on top of this growing trend for consumers to question who has access to their data and how is it being used.

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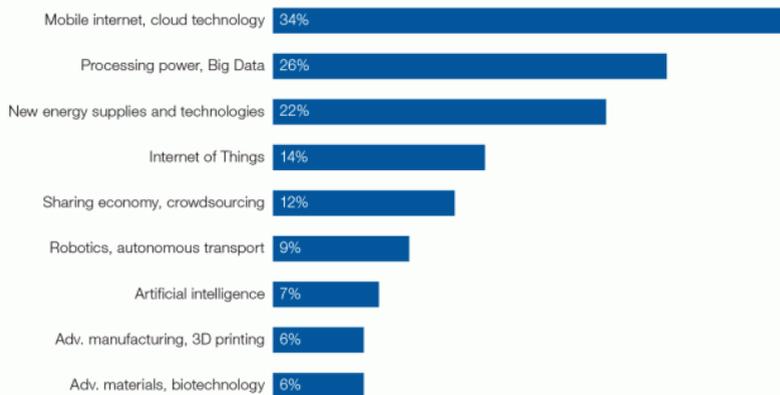


Figure 2. Drivers of Change, industries overall. Source: Future of Jobs Survey. World Economic Forum (2016).

Whilst the study does not attempt to quantify the percentage of the future workforce likely to be processing personal data in their employment, it can be implied by the overall findings that a greater number will be working with technologies that involve some form of personal data processing. In order to minimise the risk of a rise in the number of data breaches occurring alongside this growth in interconnected devices, it is important that those able to access personal data do so responsibly and are cognisant of the consequences of mishandling it.

2. Research Aims and Objectives

This research constitutes phase one of a study commissioned by the ICO to assess the extent to which HE and FE is providing students with the knowledge, theory and practice of Information Rights (IR), and to consider where the ICO may be able to provide support.

The lead research organisation for the research is Quadrant Consultants, supported by Marketwise Strategies and Zeun Digital. In order to allow for maximum disclosure of information participants in the study were assured full anonymity to ensure that responses could not be used by a competing institution. The research carried out by Marketwise Strategies employees followed the Market Research Society Code of Conduct and nothing that was divulged in interviews was reported back as having come from a specific interviewee or organisations. All raw data produced remains the property of the ICO and only summary findings were shared with partners involved in the project. As such data is not available to analyse the findings further.

Information Rights, for the purposes of this study, encompass data protection and Freedom of Information (FOI) legislation. It was acknowledged however that only a cursory understanding of FOI legislation would be necessary for most employees as public sector organisations, who are currently the only ones falling into the category required to respond to FOI requests, would likely employ someone with specialist knowledge of the legislation to respond to such requests. Conversely, as all students are data subjects in their own right, it was equally recognised that they could all benefit from an understanding of data protection legislation irrespective of where future employment might lead. It was therefore agreed that most emphasis during this research would be placed on the teaching of data protection.

One of the aims of the research was to identify which undergraduate and postgraduate degrees are currently teaching IR and to determine which were the highest priority areas for the ICO to focus its efforts on. Another of the aims was to identify and describe the most effective methods and delivery approaches to embed IR into the relevant courses, including the types of support materials tutors might be inclined to use if provided.

A key objective of the research was to establish what barriers, if any, might exist to the project moving forward, should it be decided at the end of stage one to do so, and ways to overcome them.

3. Research Methods

An initial desktop research was undertaken involving reviewing course information on institutions' websites to obtain an assessment of the evidence of the inclusion of IR in undergraduate and postgraduate courses across the UK. At the same time a database was compiled of all HE and degree-awarding FE institutions comprising contact details obtained from online public sources of Pro Vice-Chancellors and Heads of Departments.

Semi-structured interviews lasting 30 minutes were conducted by telephone with representatives of 10 professional development bodies, from across a number of identified subject areas, to obtain a better understanding of the relationship between the bodies and the institutions and any influence these bodies may have over curriculum content. It was also important to gauge support from these organisations for the ICO's efforts to improve the situation in the institutions. A number of those contacted were regulatory bodies and others, with a voluntary membership having no statutory influence over curriculum development.

A further series of semi-structured telephone depth interviews was conducted with 10 Pro Vice-Chancellors from different universities to obtain the views of decision-makers on the likelihood of the institution supporting such an initiative by the ICO. These interviews lasted between 30 minutes to one hour. All interviewees were provided with some contextual information prior to the interview to ensure they were able if needed to seek out information about the current situation in their own institution prior to the interview taking place.

Using the database compiled during the desktop research activity, an electronic survey comprising qualitative and quantitative questions was distributed to over 1300 Heads of Departments, and other individuals assumed to have some form of academic leadership role, across different institutions. The views of the Heads of Departments were important to assess the current situation in individual institutions in more detail and to identify opportunities and means of influencing curriculum development.

4. Findings and Recommendations

A list of 9 subject areas was compiled to focus attention on where students were more likely in the future to be accessing personal information: Business and Marketing; Law; IT and Computer Science; Library and Information Management; Politics and Social Science; Finance and Accountancy; Health and Social Care; Medicine; Media Studies.

The findings of the two interviews and the survey are discussed below.

4.1 Interview with Professional Development Bodies

The representative of the professional bodies were asked questions to determine the type of relationship the organisation has with the institutions and its educational responsibility. The representatives were questioned on the current situation regarding standards and monitoring of degree programmes, the importance the organisation placed on IR and on any possible barriers to embedding the topic in degree programmes under its remit. They were also asked whether there would be any support for any potential ICO accreditation programme.

All the representatives agreed that the topic of IR was of increasing importance and were supportive of the efforts of the ICO to educate the future workforce and remained open to further discussions on this with the ICO. However there were mixed views on whether the bodies themselves could influence the institutions to embed IR more firmly in courses, or indeed for some whether they should, feeling this decision was best left to individual institutions. In the main, there was a belief that IR is covered to some degree within general standards of conduct or ethics, or within a code for a particular profession, some to a greater degree than others. One of the barriers identified by the professional bodies was the technical knowledge of the legislation required to deliver the subject to an acceptable standard. However, the key barrier the representatives identified was the space in the curriculum to include another topic, if it isn't already included. When questioned about the possibility of introducing accreditation for IR the bodies were less enthusiastic stating it would likely be difficult to monitor and be a further regulatory burden on itself and on whoever was overseeing its delivery and assuring the quality.

4.2 Interview with Pro-Vice Chancellors

Pro-Vice Chancellors (Pro-VCs) were interviewed to assess the importance of IR at the strategic level of the institutions and to determine the level of support the ICO could possibly expect from the institution if it decides to move forward with a proposal. It was also important to ascertain the most effective way of influencing the curriculum across a number of subject areas.

Some of the interviewees noted that some discussion had taken place regarding IR at management level within the institutions, however all respondents stated there were other curriculum development drivers that are seen as priority to include in management strategy, such as employability, enterprise, social responsibility and internationalisation. It was clear from the responses that there was agreement on the importance of the topic and some acknowledgement that generally not enough IR was currently being taught across many of the disciplines mentioned, although there is evidence in some institutions, mainly in disciplines such as law and health and social care, that IR is included explicitly within the subject curriculum.

Some of the barriers to expanding the teaching of IR from the Pro-VCs perspectives tended towards issues with the time and expense needed to do so. It would be necessary to develop subject expertise amongst tutors and materials of a sufficient quality to ensure the same level of core knowledge was imparted across the institution.

The support of the ICO was welcomed to assist teaching by producing materials and offering training to staff, however there would also need to be buy-in from students and individual tutors alike. Some form of accreditation that could be offered to students was seen as a potential way of selling the benefits of understanding the legislation to students. Tying the subject into a strategic driver such as employability would ensure the topic was taken seriously by tutors at course and module level.

4.3 Online Survey with Heads of Departments

Over 1300 invitations were disseminated resulting in a total of 170 responses, with a response rate of 13%, across the disciplines identified. All of the respondents stated they had some responsibility over curriculum design and 85% said that it was either likely or very likely students graduating from degrees in their discipline would in future work in roles that require an understanding of data protection legislation.

Nearly half of the respondents stated they have already embedded IR into their teaching and a further quarter were already committed to changing teaching to do so. Of these 73% of respondents however, three quarters said that it currently constituted a relatively small part of a module. When asked to consider if IR had to be embedded within a course 59% favoured it being subject specific and taught within a module compared to 15% preferring a cross-curricular approach; a quarter of respondents thought a hybrid approach would work best. When asked if the ICO were to provide high quality materials to support teaching of IR 73% said they would be likely or very likely to use them. All types of materials suggested, including case studies, videos, information sheets and interactive materials available via a virtual learning platform, received favourable responses.

Only 45% of respondents said they would be likely or very likely to use an ICO certified assessment tool if one was produced. However, 58% thought that if the ICO offered some form of accreditation for courses that embedded IR firmly within its structure this would act as a motivator to do so.

5. Conclusions

The growing importance of IR, is generally accepted by all participants in this study. The continuing growth in the volume of personal data in existence and the changing nature of the workplace, fueled by the “fourth industrial revolution”, means it is increasingly likely that students today will end up in roles tomorrow that necessitate greater care being taken over processing of that data.

In an effort to improve the current state of affairs the ICO commissioned this study to assess the situation in HE and FE and found that whilst there are examples of IR being taught it is not widespread nor done in depth in many instances. Many barriers were identified, most notably the lack of expertise in the subject matter and access to good quality materials suitable to each subject area identified. However most respondents reacted favourably to the offer of ICO support in this regard and professional bodies in particular were on the whole open to working closer with the ICO although this with the understanding that there is little room or enthusiasm to add to the regulatory frameworks already in place.

Whether Phase 2 of the project will be completed and if so, where the effort will be concentrated is dependent on the findings of Phase 1 and has yet to be decided by the ICO.

Most institutions reacted favourably to support by the ICO with materials and training, and around half would welcome some form of accreditation by the ICO for courses that make a concerted effort to cover IR. However, initiatives such as these were not seen by most as enough of a motivator to encourage all curriculum developers to make the widespread changes needed. One effective way recognised by many to implement wide scale changes to curriculum would be through management strategy and embedding the teaching of IR into a current driver such as employability.

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Public University Models for Education – from Innovation to Entrepreneurship

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Abstract

The management of Australian public universities has changed dramatically over the last two decades with the decrease in public funding across teaching and research sectors. This has forced a strategic repositioning of universities and likewise a rethink on value generation and its translation into various revenue streams. The aim of this paper is to provide an analysis of current government innovation policy and university capabilities to support the translation of innovation, and in so doing explore the possibilities of a Quadruple Helix innovation approach to building new models for education. The paper begins by examining the significant role innovation plays in developing economic wealth, and a discussion of the triple helix framework that identifies the complex collaborative relationships between universities, government and industry. The development of a Quadruple Helix Innovation Model, which places the user at the centre of the relationship, highlights the importance of capabilities in the transmission mechanisms driving innovation. We argue that the measurement of appropriate capabilities formed through collaborations amongst key stakeholders will be critical to new business models. Universities are encouraged to embrace the user value driven business models to provide the innovation, execution and disruption necessary to quadruple the impact on national growth.

Keywords: *University, Entrepreneur, Innovation, Business Model, Quadruple Helix, Empirical.*

1. Introduction

Innovation and entrepreneurial activities are recognised engines of long-term economic growth (Wang, Peng, & Gu, 2011). Innovation results in continuous improvement and sustained competitiveness against on-going imitation by competitors, introduction of newer products/services and obsolescence (Rubera & Kirca, 2012). However, the capitalization of benefits and externalities associated with innovation is not limited to the investing company but also society at large, e.g. commercializing novel pharmaceutical drugs result in career opportunities, better collaboration on new knowledge and opportunity for leverage into newer areas (PISG, 2008). Entrepreneurial activities may result in a substitution effect where older firms with less potential are replaced by newer and more successful firms (2007).

The recent Australian Government's National Innovation and Science Agenda (Innovation Agenda, DoPMC, 2015) actively seeks to capitalize upon the nation's innovation and entrepreneurship from public universities, as well as cultivate future Australian innovators through a revision of the junior and middle school's education curriculum. To enable this agenda, the literature postulates the existence of a collaborative relationship between universities/research-institutes, industry, government and civil society, known as the quadruple helix (QH) framework. The QH framework has been used to articulate knowledge sharing, direct research activity, provide a lens to understand the complementary/synergistic nature between different stakeholders, and drive higher economic growth rates (Afonso, Monteiro, & Thompson, 2012). Research application of the quadruple helix framework can assist stakeholders in focusing the innovation process more effectively to trigger and deploy creative capabilities faster and with greater effect (e.g. to respond to external or internal opportunities for new ideas, processes or products).

- To reconnoiter this agenda our research paper seeks to:
- Explore the transformational state of Australia's leading public universities (Go8) into entrepreneurial universities
- Compare current metrics that evaluate the state of university innovation/entrepreneurship within a QH framework.

2. Literature Review

The translation and commercialization of university research are widely acknowledged by both policy-makers and scholars as being an important driver of innovation, economic growth, employment, and solutions for global challenges (e.g. European Commission, 2014). The resource-based Quadruple Helix (QH) literature provides us with a lens and a language to explain how these processes occur.

2.1 Quadruple Helix (QH) Literature

The triple helix model is a meta-model, that advocates for regions of translation which could enable couplings between the active systems of Government, University and Industry (Helms & Heilesen, 2011). At a strategic level it assumes a top-down approach based on the contributions of experts from each of the systems. Building on Etzkowitz et al. (2007), Arnkil et al. (2010) added “the user” as the actor at the centre of the helix, giving rise to a set of innovation models that have four interacting components and thus a quadruplet. In contrast to the top-down triple helix meta-models, the QH models recognize that non-expert citizens acting as users or consumers actively participate in the co-production of new knowledge and new products. As yet, there is no universally accepted definition of the QH concept. Figure 1 shows a simplified form of the QH model, where all four “systemic actors” are broadly defined, e.g. user involvement in development. While relationships exist between each “actor”, e.g. administrative, cultural, and economic, users can also be viewed in terms of a particular human need.

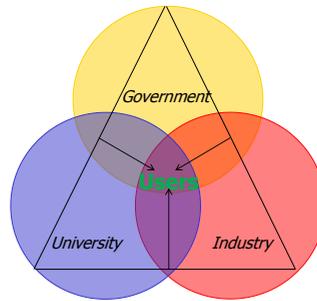


Figure 1 A Simple Quadruple Helix Model of Innovation (adapted from Arnkil, 2010)

Building on the work of Arnkil et al. (2010), we postulate a variant of the QH model combining roles, relationships and dependencies between government, business and educational institutions that is constantly undergoing changes in structure, content and function (see Figure 2).

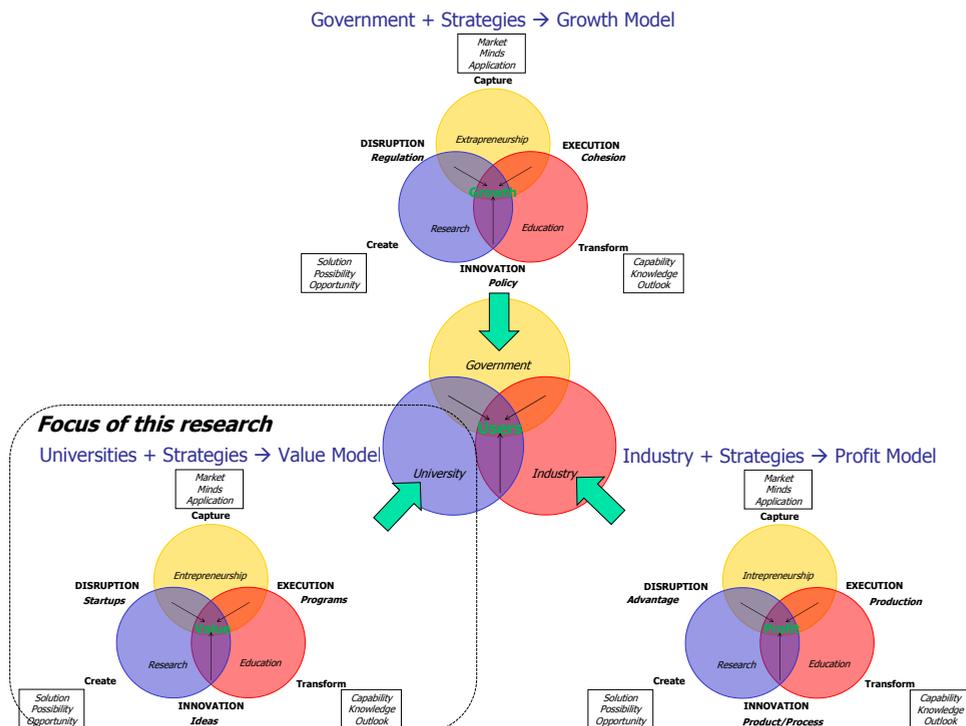


Figure 2. Macro Quadruple helix innovation model

The purpose of this variant is to reflect the operationalization of the Innovation Agenda (DoPMC, 2015) from a knowledge institution (university) point of view. In this QH structure, universities would be developing services (e.g. courses and learning objects), supporting user involvement in the development of products, collecting information about users, and supporting the dissemination and sharing of products. Government would support research, development, networking, knowledge dissemination as well as be the end user of resultant technologies. Industry would support research and development activities, make use of all available know-how in implementing commercial solutions, and collect information on user needs. In both industry-centred and government centred models, users would contribute experiences, generating ideas, and be involved in the development and implementation of innovations (entrepreneurship).

Of course, the traditional roles of government (e.g. regulation), and industry seeking profit (e.g. via disruptive advantage), are still taking place and are part of the relational dynamic. However, due to the changes in the global economy, these roles are constantly undergoing changes. For example, the primary objective of the Innovation Agenda (DoPMC, 2015) is to enable a societal innovation ecosystem within which all “actors” have a means to interactively improve the growth, value and leverage of “final-users”. The purpose of the

agenda is to establish frameworks for interaction, and then let actors work towards solutions. However, entrepreneurial-actors within the Australian ecosystem are concerned with consequences of risk taking (bankruptcy) and lack of a sizable consumer market. To minimise these risks entrepreneurial-actors choose to commercialize or relocate operations to the United States or Europe, resulting in a cycle of bounded capability. To address this, the Australian government has pledged to expand its role from a patron to a consumer of research. In this way, the innovation policy platform moves from a tool for developing the agenda to a systemic process for final-user implementation/consumption.

2.2 Research Questions

To address the research aims, this paper proposes the following questions:

RQ1: What entrepreneurial capabilities currently exist within Australia's Go8 Universities that support a QH framework?

RQ2: What metrics are needed to evaluate university entrepreneurial capabilities in a QH framework?

3. Methods

Against the context of the Australian Government's Innovation Agenda (DoPMC, 2015), our Research Questions seek to provide an insight into the strategic capability of public universities within a QH framework of innovation. The availability of data for these purposes is always problematic due to the complexity of obtaining primary information from a vast array of public institutions (i.e. universities). A secondary data quantitative research design was thus deemed appropriate for this exploratory paper due to the lack of research into the role public universities play in the conceptualisation of the QH framework. To that end we accessed a variety of Australian government longitudinal panel data sets that have been collected from the Australia's Go8 Universities between 2002-14 from the Department of Education as well as the Department of Industry, Innovation and Science. A longitudinal approach is appropriate for this paper because the approach allows trends between implementation and outcomes to give a more systemic view of relationships between policy input and translated innovation output.

The reports we accessed attempt to capture research commercialization of publicly funded Australian universities in terms of:

- inputs (e.g. revenue streams student fees and research, revenue from active licenses and commercial contracts)
- activities (e.g. research expenditure, and assigned manpower to commercialization activities, number of research consultancies)
- outputs (e.g. startups, license agreements and (provisional) patents filed).

Even though the NSRC strives to present a holistic view of the University sector's efforts to commercialize its research, the survey is not without its flaws. *Firstly*, some data are missing, perhaps due to the difficulty, size and complexity of these organizations (Litan, Wyckoff, & Fealing, 2013), and perhaps an unwillingness to disclose information e.g. expenditures associated with innovation and commercialization. Evidence of such discrepancies can be found in the following years; 2011 where a number of universities (UoS, UoM, UWA and UoA) did not report any research expenditure, and in 2012 where the UoQ did not report any information on royalties, patents or consultancies. Therefore, in order to derive meaningful information, methods of interpolation using the average of the prior and subsequent year's figures were used to complete the dataset. *Secondly*, the NSRC 2013-2014 report states that while the survey provides longitudinal data to capture trends and key data sets, much of the information gathered does not yet provide enough detail or depth to support micro decision making. However, the comparative data assembled here does support the need for more than a policy agenda.

4. Findings

To examine the current status of Go8 Universities in a QH framework, we have assembled in Table 1, a collection of the various core university data from 2008-14. We have structured this across proxies for key dimensions of the QH (Education activity, Research activity, Entrepreneurial engagement), the linking proxies across each of these (Innovation, Disruption, and Execution of Entrepreneurial Programs), and finally tangible Value created.

What we see from Table 1 is that education and research activity (indicated by revenues) are very strong, and in all but one case education dominate, and in the case of UoA by a factor of almost x2. In terms of entrepreneurial engagement there appears to be evidence that research contracts far outweigh consulting contracts to the broader (industrial) community. This data tends to confirm that the research focus of Australia's Go8 Universities is internally driven by discovery as opposed to application.

With regard to innovation, there is strong evidence of the links between knowledge and research, indicated by the number of patents/provisions filed and number of active licenses. However, there is evidence that Australian institutions underperform compared to their international counterparts, the UK, Canada and the US, for invention disclosures per \$US100m research expenditure. For example the number of invention disclosures per \$US100m research expenditure in Australia was 28.8 in 2011, compared with the UK (43.7), Canada (41.6), the US (35.8) and Europe (28.4) (DIISRTE, 2012). Also the number of Licenses, Options and Assignments executed per \$US100m research expenditure by Australian institutions at 8.3, is less than the 13.2 in Canada, 10.6 in Europe and 9.9 in the US.

Start-ups as a proxy for disruptive activity are also very weak. Australian start-up companies formed per \$US100m research expenditure have gradually declined from a peak of 2.2 in 2001 to less than 0.5 in 2013. The data in the UK and Canada showed a similar decline over the same period, but the number was much higher at 2.8 in the UK in 2010, 3.2 in Europe and at 1.6 in Canada in 2011. The US has maintained a stable rate of start-up company formation per \$US100m research expenditure at around 1.1 over the last decade. In terms of tangible value created, the top five of Australia's Go8 Universities generate healthy revenue in excess of AU\$ 1 Billion per year, with the bottom three close to that mark. The data also suggests that less than 10% of this revenue is from sources other than government, and that the motivation for actively seeking this external revenue is very small.

In the case of Execution of Entrepreneurial Programs, it seems that Australia's Go8 universities generally do not see producing entrepreneurs as a major part of their role and as a result, do not significantly invest in programs to create entrepreneurs to the same degree as universities internationally.

Table 1. Brief assessment of the QH programs being executed by Australia's Go8 Universities

	University of New South Wales (UNSW)	University of Sydney (UoS)	Monash University (MU)	University of Melbourne (UoM)	University of Queensland (UoQ)	University of Western Australia (UoWA)	University of Adelaide (UoA)	Australian National University (ANU)
Education activity								
Average student fees from 2008 – 2014 (x,000) (including government assistance)	773,150	857,129	810,738	887,461	812,458	447,661	433,115	606,853
Research activity								
Average research revenue from 2010-2013 (x,000)	647,013	678,962	815,021	950,921	694,540	308,485	228,886	494,315
Entrepreneurial engagement								
Average number of consultancy contracts 2010-2013	341	179	0	122	290	0	202	37
Average number of research contracts 2010-2013	1,257	168	262	395	1,189	107	955	165
Innovation								
Average number of patents and provisions filed 2010-2013	81	86	90	75	114	32	25	17
Average number of active licenses from 2010-2013	166	52	27	63	642	28	77	44
Disruption								
Average number of start-ups from 2010-2013	2	0	1	1	4	1	0	0
Executed Entrepreneurial Programs								
Estimated Stage of Development (1 – 6)	3	3	2	2	1	4	2	1
Tangible value created								
Average revenue from 2008-2014 (x,000)	1,387,653	1,614,764	1,530,356	1,710,846	1,489,997	832,465	736,555	936,411

Source: Annual Reports from Federal Government agencies; Department of Industry Innovation and Science (National Survey of Research Commercialization-NSRC) and Department of Education.

5. Discussion

We sought to answer two questions in this brief paper. In RQ1 we asked; What entrepreneurial capabilities currently exist within Australia’s Go8 Universities that support a QH framework?

Drawing on the QH and Table 1, we suggest in Table 2 that Australia’s Go8 Universities show demonstrable capability across the linking mechanisms of the Helix, albeit to varying degrees. However, we believe what’s missing are the research and education capabilities necessary to develop the entrepreneurship capabilities required from the Government’s Innovation Agenda.

From a teaching and learning perspective, these entrepreneurship capabilities need to be student-centred rather than teacher-centred. Moreover, the nature of learning should move away from traditional classroom teaching to short courses and experiential approaches that expose users to a rigorous, innovative, open and relevant curriculum. These approaches have the potential to develop both knowledge and skills in the application of innovative knowledge to entrepreneurial outcomes, along with opportunities to work closely with alumni, industry representatives and entrepreneurs in residence.

Research	LINKs	Entrepreneurship	LINKs	Education	LINKs
DISRUPTION		EXECUTION		INNOVATION	
Create		Capture		Transform	
MISSING	AVAILABLE	MISSING	AVAILABLE	MISSING	AVAILABLE
Possibility	Startups	Markets	Edu.Programs	Capability	Idea.Patent
Opportunity		Mindset		Knowledge	
Solution		Applications		Outlook	

Table 2. Quadruple Helix Metrics Available / Missing

In RQ2 we asked; What metrics are needed to evaluate university entrepreneurial capabilities in a QH framework?

While generally supportive of the Innovation Agenda, the Go8’s current stance draws heavily from its research-intensive focus by asserting that discovery research has the greatest impact. Such motivation and resourcing must be reoriented to deliver value in a QH framework via intentional translation/commercialisation. We feel that while discussions around business model development or how to address conflicting business models are constructive; the bigger issue at hand is the determination of metrics relevant to the QH that can lead to change.

From Table 2 we suggest some of the new metrics that should be considered in the measurement of capability under Research-Creativity, Education-Transformation and Entrepreneurial-Capture.

6. Conclusions

We have used an existing Federal Government reporting/evaluation structure as a starting point to the measurement of the QH concept framework.

Though convenient and less disruptive, this approach will not result in the desired QH effect due to the risk of reinterpreting data while hoping for a new outcome. There must be first and foremost appropriate methods to capture the particularities and desired capabilities, and confronting the disruption that will bring about change and improvement. Measurements of the proposed QH framework must adequately reflect the different capabilities of an entrepreneurial university while capturing the universities' interaction between resources from industry, government and users. Our proposed capabilities structure link closely to the proposed QH concept framework to develop a more holistic measurement for the entrepreneurial university. Knowing what the desired outcomes are will provide a template for the strategic outlook required, improved resource planning/utilisation, and reward schema that apply equally across the academies of education, research and entrepreneurship.

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Pedagogy and content evolution in cross-border higher education: Evidence from an American-Singaporean cross-border partnership

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Abstract

Reflecting larger trends in business, economics, and communications, the field of higher education has undergone a rapid period of globalization and internationalization over the last half century. While much scholarship has been devoted to the policies and practices of cross-border higher education work, little research has examined the mechanisms by which educational practices and approaches are modified and adapted when moved across cultural contexts.

This paper addresses this gap by examining the processes by which foreign and local partners adapted and modified American educational approaches to fit the needs of Singaporean students in a large-scale cross-border higher education partnership. Developed based on a year of immersive ethnographic fieldwork at the Singapore University of Technology and Design – a new university established in collaboration with the Massachusetts Institute of Technology – the findings of this paper show that local and foreign partners utilized three distinct strategies to modify American pedagogical and curricular approaches to fit the needs of the Singaporean context: collaborative mentorship and guidance, incremental modification of content and practice, and enabling and facilitating student-driven change. This paper presents an overview of these findings, as well as their implications for future work.

Keywords: *Cross-border higher education; Globalization of education; Engineering education; Pedagogy.*

1. Introduction

Since the middle of the twentieth century, the forces of globalization have impacted virtually every facet of modern-day economic and political life, integrating independent nations and economies into one global, interdependent system (Stromquist & Monkman, 2000). While this force of globalization is most often discussed in terms of its impact on the world economy, the field of higher education has been profoundly impacted by globalization forces as well (Wildavsky, 2010), notably through the marked rise of cross-border higher education (CBHE) partnerships in recent years (Sakamoto & Chapman, 2011). While these partnerships may take many forms, the largest and most resource intensive examples of these partnerships are cases in which one university aides in the establishment of a new higher education institution overseas, either in the form of an international branch campus (IBC) or a new independent, degree-granting institution (Lane, 2011; Wildavsky, 2010).

While much scholarship has been devoted to the study of these cross-border institutions, most past research assumes a structural, “center-periphery” model of the global education space, wherein Western institutions sit at the “center” of the higher education marketplace, levying their ideas on other nations sitting at the “periphery” (Shils, 1972). In this system, institutions in the countries at the periphery act as consumers of knowledge delivered by the central actors without consideration of the “otherness” of uniquely local ideas, approaches, and methodologies (Altbach, 1998; Young, 1997). Given these underlying assumptions, most existing research in cross-border higher education largely ignores the agency of local actors to modify the practices and approaches brought to them by their international collaborators within the context of cross-border partnerships (Amthor & Metzger, 2011).

In contrast, the research presented in this paper seeks to highlight the individual agency of local actors in cross-border partnerships by examining the processes by which they unilaterally and collaboratively modify “imported” educational practices to fit the considerations of their local cultural context. Although foreign and local actors in these collaborations likely modify educational practices as they travel between cultural contexts in myriad ways, the scope of this paper is limited to curricular and pedagogical adjustments within an undergraduate freshman year course sequence.

2. Research Setting: The MIT-SUTD Collaboration

In 2010, the Massachusetts Institute of Technology (MIT) entered into an agreement with the Singapore Ministry of Education to create the Singapore University of Technology and Design (SUTD), a new engineering and technical university offering design-focused undergraduate and graduate programs. While SUTD was not designed to operate as an international branch of MIT, MIT faculty and staff were involved in all major aspects of planning for the new university, including curriculum design, faculty hiring and training, implementation of student programs, and development of a joint research program, among others. After the initial planning stages, MIT faculty and staff continued to serve as active advisors and collaborators as SUTD entered full operation, admitting its first class of students in 2012 and moving to its permanent campus in eastern Singapore in 2015.

MIT faculty had a particularly active role in developing SUTD's courses, specifically the curriculum for SUTD's multidisciplinary "freshmore" year. This curriculum consists of a common, three-semester sequence of introductory science and engineering courses offered to all undergraduate students. Initial planning for these courses was conducted by MIT faculty, and then delivered to SUTD instructors for implementation as faculty were hired at the new institution. While MIT faculty provided thorough materials for each course – including syllabi, course slides, homework sets, examinations, and in some cases course readings – SUTD faculty were given opportunities to modify the course materials as they saw fit, often under the guidance of MIT mentors. In addition, several MIT faculty members participated in long-term residencies at SUTD, co-teaching or mentoring instructors as they delivered the first iterations of these courses to the pioneer undergraduate students. As SUTD developed and became more established within the Singaporean higher education landscape, the active role of MIT faculty members gradually diminished; however, many of these stakeholders still maintain active advisory roles today.

3. Methods and Data Collection

The findings in this paper stem from interview and observational data collected at MIT and SUTD in 2016 and 2017, during the fifth delivery of the freshmore course sequence. Interviews and observations were conducted at both SUTD's campus in Singapore and at MIT's campus in the United States, and are part of a larger ethnographic study examining cross-cultural aspects of the MIT-SUTD Collaboration as a whole. The findings below draw upon data from 69 interviews of MIT and SUTD staff, faculty, and students, as well as observations of SUTD's freshmore year courses and their corresponding courses at MIT.

4. Findings: Pedagogy and Content Evolution in CBHE Collaborations

Throughout the research interviews and observations performed during the process of data collection, I identified several methods by which local actors at SUTD worked – either unilaterally or in collaboration with MIT stakeholders – to adapt the freshmore educational approach as designed by MIT stakeholders to fit the Singaporean context. These methods were: (1) collaborative mentorship and guidance, (2) incremental modification of content and practice, and (3) enabling and facilitating student-driven change.

4.1. Collaborative Mentorship and Guidance

As new faculty members were hired to join SUTD, MIT faculty maintained an active role as mentors and instructors for these new faculty, helping them as they developed and adapted their freshmore courses, even serving as mentors and co-instructors as new courses were delivered at SUTD. This mentorship occurred in three ways: through on-site visits, a formal faculty training program, and remote consultations.

In the first several years of SUTD's operation, numerous MIT faculty and staff made visits to SUTD to provide guidance or aid in co-teaching of the freshmore year courses in person. For example, one MIT faculty member made annual, long-term trips to SUTD for the first five years of the freshmore course offerings, teaching guest lectures and aiding the SUTD teaching team as they planned and reorganized their freshmore year courses. Although this faculty member would often stay in Singapore for weeks or months at a time, other MIT faculty served similar roles during shorter visits, aiding in course delivery especially during the early weeks of semesters. In speaking with SUTD faculty, many found these visits invaluable, and would maintain relationships with their MIT colleagues even after they returned to the United States.

As part of the initial agreement between MIT and the Singaporean Ministry of Education, MIT also developed an immersive Faculty Development Program to help train and acculturate the first faculty hires at SUTD. Through this program, new SUTD faculty members participated in two to twelve month residencies at MIT, during which they participated in pedagogy workshops, engaged in collaborative research, and were mentored by senior MIT faculty. Although not all faculty used their time in this program to develop or modify their undergraduate courses or the curriculum, some did—for example, one MIT faculty member described how an SUTD Humanities, Arts, and Social Sciences (HASS) professor spent his time at MIT in part preparing a proposal to modify the freshmore HASS courses from pure humanities (as designed by the original MIT course designers) to an integrated humanities and social science sequence. Said this MIT professor:

Once you have human beings there, you have to work from them and create a community of them and have them feel comfortable in owning it [the curriculum] to have it [be] effective, so that's what you do. [...] One of the more local inequities is that by having the freshman core be all humanities in approach – multiple humanities, but still humanities –you had faculty in social science who neither felt comfortable nor interested nor particularly qualified to teach that. So they were developing upper level electives, and all the people who had some qualifications – no matter how you evaluated those – in the humanities were teaching the freshman core and only the freshman core. [...] So finally, [a HASS faculty member] was here last year for a while helping to sort of think through how they could diversify the freshman sequence. So they basically shifted it for this totally reasonable staff driven [reason], as well as [to] balance those two dimensions of the HASS curriculum.

While not every participant in the MIT-SUTD Faculty Development Program engaged in this type of planning activity during their time at MIT, all received mentorship from MIT faculty members and some feedback on their teaching and pedagogy, illustrating another means by which this program may have affected and adapted SUTD faculty teaching.

When MIT and SUTD faculty were not provided with opportunities for in-person mentorship, many still maintained remote relationships, with MIT faculty providing virtual guidance and support as SUTD faculty ran through iterations of their courses. While this ongoing mentorship was not required of all MIT faculty participating in SUTD course development, several faculty went “above and beyond” the required content delivery, providing continuous mentorship and support throughout the first few iterations of the freshman course offerings. Said one of the freshman course leads at SUTD: “I actually knew the instructor quite well, and he actually sent more [materials] than MIT had to.” In addition, this MIT faculty member also provided remote guidance as these additional materials were delivered, and also coordinated annual visits to provide in-person feedback to the SUTD teaching team. In another case, a senior faculty member at MIT developed a proposal to combine and restructure two of the hard science courses in the freshman curriculum, a proposal that was ultimately adopted and then implemented (with many modifications) by faculty and administrators at SUTD, illustrating another case in which the mentorship and guidance of MIT faculty helped SUTD stakeholders continue to develop and modify the freshman year curriculum over time.

4.2. Incremental Modification of Content and Practice

When interviewed about the curricula and teaching of the freshman courses during the first years of SUTD's full operation, SUTD faculty and staff described a process in which they incrementally adapted the original MIT-designed syllabi and course content based on their own experiences offering the courses to students. For example, one freshman math teacher discussed how through the first few iterations of his course he had discovered that Singaporean students sometimes struggled to solve open-ended problems given their background in the Singaporean educational system, and modified the content of his course each year to provide more scaffolding for students as they learned techniques to approach and solve these types of problems. Similarly, the SUTD freshman design course also underwent numerous structural and content changes in the four years it has been offered; said one freshman design instructor of this process:

The first year, [the design course] was a real shock to the students. The second and third year it evolved slowly into something that was not such a shock to the students. So it evolved in a way to accommodate the students that we have here that are different from the students from other places where design is also taught. So there was a lot of structure in the first year, but also a lot of unknown; a lot of searching in terms of methodologies that they would need to do but a lot of unknown in what to do the project. So then the methodology started slowly disappearing more, [...] and when I arrived last year and now, we are putting a little bit more structure into it.

While these changes may be viewed as efforts to simplify or streamline course material, in other cases faculty worked to develop structures to provide additional opportunities for advanced students in response to their performance in the freshman courses. For example, an instructor for the freshman physics sequence described how he and his colleagues decided to develop an honors section for the freshman physics classes, through which they challenge the students who are too advanced for the standardized classes. Although currently voluntary and not for credit, this faculty member hoped that these classes would eventually be institutionalized into the freshman year curriculum, as they were designed to fill an important need he identified when teaching the first batches of students. As these examples illustrate, faculty and staff at SUTD performed incremental modifications of the original MIT-designed freshman curriculum in several ways, generally in an attempt to make the curriculum and pedagogy more appropriate for the needs of SUTD students.

4.3. Enabling and Facilitating Student-Driven Change

In several cases, faculty and staff also discussed the ways in which students played roles in adapting the MIT-developed courses to the context of SUTD. According to faculty, this influence occurred in two primary ways: through student course evaluations and feedback and through adoption of student-driven curricular initiatives.

In interviews and informal conversations, SUTD faculty would often discuss how frank their students were when providing feedback on courses, specifically when students felt as if course content was too difficult or not being delivered in an effective way. Although faculty members did not always incorporate the students' specific requests, they did take their general feedback into account when planning classes each year. Said one freshmore math instructor of this process:

The course has evolved, I guess, mostly as reactions to the student feedback that we have been receiving. And one thing about the students here is that they are quite demanding. [...] In the beginning, they complained... something about there not being enough practice problems or there were no sort of resources outside the slides and so on. So the course lead back then decided to, you know, give them an e-book to read, you know, not to read the whole book; just a few pages a week. [...] So they really hated that. So, anyway, so the year after that, that is, and that is when I got involved. So we got rid of the e-book and the compulsory reading. We took out some of the more complicated topics. And then we set a textbook that was, you know, we considered to be more classical and perhaps easier to read and the students responded better to that, but still no one read the textbook.

In other cases, faculty and staff provided examples of instances in which SUTD students approached their instructors with concrete proposals for curricular or content changes, outside of formal course feedback mechanisms. For example, during the freshmore year the faculty coordinate "2D projects," in which students are divided into teams to engage in a cross-disciplinary project integrating concepts from all of their courses in a particular semester. For the first few cohorts of SUTD students, the same project was offered in the first term each year; however, students eventually developed a desire to change this project, and approached the faculty with a request to develop a new proposal. Under the guidance of a faculty mentor, a group of students developed a plan for a new project, which was ultimately adopted and integrated into the freshmore curriculum. In this case, an idea developed independently by the students was implemented due to the support and facilitation of SUTD staff and faculty, illustrating another method by which local stakeholders adapted the curriculum to fit SUTD's needs.

5. Conclusions and Future Work

As is illustrated by the above findings, while MIT faculty clearly had a large role in defining the structure and content of the freshman course sequence at SUTD, local faculty, staff, and students also had a large influence on the way that these courses were and are delivered at SUTD. While MIT faculty made efforts to develop a culturally and contextually appropriate sequence of freshman courses at SUTD, particular aspects of the local culture and educational system – including student preparation, faculty expertise, and student interest, among others – necessitated that SUTD stakeholders modify the original MIT course plans to fit the Singaporean educational context. To make these adjustments, SUTD stakeholders acted either unilaterally or in collaboration with MIT faculty, utilizing the three modification processes described above. These findings support a post-structural understanding of the cross-border higher education space, wherein local actors hold important, influential roles in modifying foreign educational practices (in this case, a curriculum and pedagogy developed by MIT) to fit the needs of their local context.

Although the findings of this paper illustrate that faculty and staff of cross-border higher education collaborations may use the techniques of collaborative mentorship and guidance, incremental modification of practice, and facilitation of student-driven change to localize educational content, it is unclear whether or not similar techniques are used in other aspects of cross-border collaborations, such as student life or campus design. Future work in this area should examine whether or not these techniques are utilized in other aspects of cross-border collaborations, and should seek to identify other processes by which actors in CBHE collaborations modify practices to fit local contexts.

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The ICT and gamification: tools for improving motivation and learning at universities

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Abstract

The teacher-student technology gap and the lack of attention in the design of attractive and motivating learning methodologies often result in student's demotivation and poor academic performance. To this end, from the research field, a series of methodologies and tools have been developed, such as gamification, as well as the introduction of ICT in lessons.

By implementing Socrative, a classroom app to engage students, we tried to measure the evolution of students' knowledge after the use of ICT and more interactive lessons. In addition, we tried to relate the level of motivation to students' seating plan in the classroom (in rows). We also tried to analyse students' preferences and their feedback of the new techniques and methodologies used during the classes.

The main result of the research is that the use of ICT and gamification in the classroom improved students' motivation and learning, especially those who were less motivated. The direct relation between the students' seats in the classroom and their motivation was verified. At the same time, the learning differences between all the students in the classroom were reduced, achieving a balance between the learning and the motivation of the students.

Keywords: *Smartphone; incentive; learning; university students; Socrative.*

1. Introduction

In recent decades, Information and Communication Technologies (ICT) have experienced a rapid technical progress that has resulted in new forms of social relations and new channels of transmission of information. These changes modified the behaviour of all age-groups, but the main impact have been on the most recent generations¹, where the use of ICT are as daily as any other basic activity of the day. These new generations have grown up in a digital and interconnected environment and they respond to stimuli and interests in different ways compared to previous generations. However, in most cases this "student body 2.0" receives training based on traditional teaching methodologies, such as strictly theoretical classes. In many cases, this is due to the fact that educational professionals have failed to understand the impact that ICT have introduced in the life of students (Fructuoso, 2015). Additionally, in the university environment many teachers assume that students are motivated, supposedly, because this level of education is voluntary and theoretically students enroll in those degrees which best fit their interests. However, it is a mistake to think that students are naturally motivated by the learning process (Lopez, 2004).

The teacher-student technology gap and the lack of attention in the design of attractive and motivating learning methodologies often derive in demotivation and low academic performance on the part of the student body. The motivated and resilient students do so in the face of any situation and/or teaching methodology, however the unmotivated students don't do it. Therefore, it is necessary to research new learning methodologies that manage to attract the interest of those unmotivated students since it is fully demonstrated that a motivated student will achieve a higher academic performance that, in general, will become a better performance of their professional activity (Rinaudo Et al., 2004).

Two great typologies of motivation can be distinguished: intrinsic and extrinsic motivation (Condry and Chambers, 1978; Pekrun, 1992; Anaya and Anaya, 2010). Intrinsic motivation is the one that is under the control of each person and has the ability to self-reinforce; while extrinsic motivation is the one that depends on external factors and affects the performance of tasks (Anaya and Anaya, 2010). There is an extensive literature on the factors that influence the motivation of student learning. Some authors state that the realization of classes with varied activities, less theoretical and more interactive, contributes to increase the motivation of students (Mosquera, 2003). Some of these activities are the viewing and commentary of documentaries, the realization of debates with assignment of roles and even the accomplishment of contests and quizzes based on the subject explained in previous classes, reassuring the knowledge of concepts already taught.

¹ These new generations born between 1994/95 until 2010 are known by the researchers by the name of "Z Generation", "Generation of the Millennium" or "Digital natives", which have a greater dependence on the virtual world and the technologies, getting to have a digital hyperactivity.

It is important to understand that "new students" have incorporated the dynamics of games and digital environments (freedom of decision, speed of decision making, immediacy of response, personalisation of the environment and action) to their behavioural logic. The introduction of these game dynamics into teaching practice has proved to be a very effective method in the process of knowledge acquisition; this technique has been tested in different knowledge contexts and their educative effects have been proved (Labrador et al., 2016). This technique based on the incorporation of game methodologies to improve the motivation in the learning processes is called "gamification" (Sánchez, 2015).

The following is a case study, carried out with the students of the subject of Geography of Europe of the Degree of Geography and Environment of the University of València, where some innovative methodologies and teaching tools have been applied and little used in the universities in order to improve students' motivation and performance.

2. Objectives and Hypothesis

The main objective was to measure the evolution of the students' knowledge of the Geography of Europe subject of the Degree of Geography and Environment, after applying a theoretical-participative teaching methodology where the gamification and the use of ICT would have a significant weight. In addition, we also sought to know the opinions and preferences of students regarding the teaching methodology used.

The study starts from a series of initial hypotheses:

- The distribution of students in the classroom is related to their motivation, hence the students with a lower level of motivation are in the rear rows.
- The introduction of participation techniques and ICT will improve the performance of students, especially those who are less motivated.
- The students have a greater preference for participatory teaching methodologies with a greater use of ICT.

3. Methodology

The group of study/control group was made up of the students of the subject of Geography of Europe of the first course of the Degree of Geography and Environment of the Universitat de València. The proposed methodology was developed along the thematic unit IV of the subject, within the framework of the mentoring program of the *Formación Integral del Profesorado Universitario (FIPU)* taught by the *Servei de Formació Permanet i Innovació Educativa (SFPIE)* of the Universitat de València.

For the study, we analysed the results of the students who participated in all the activities carried out, obtaining a sample of 24 individuals. The results of the students who often did

not attend the lessons and who, therefore, were not involved in all the proposed activities, were not taken into account. Throughout the research process the students kept the same seats (in rows) they chose the day of the initial test.

During the development of the classes the theoretical explanation was combined with activities that required the direct participation of students such as the viewing of audiovisual material and reading of documents, commentaries, debates, and group discussions as well as the realization of games and quizzes related to the subject explained in class. The lessons followed the structure below:

1. Sample Student Ranking and review of questions with worse results.
2. Theoretical-Practical classes (viewing of documentaries, readings, debates, quizzes by groups, etc).
3. Test on the subject taught during the session.

3.1. Applications

Initially, three programs were selected: Kahoot, Spiral and Socrative. The main feature that unite these programs is their free access on the internet, which was necessary for students to do it. In addition, all three programs are compatible with Android and IOS, so students could use them in class on their laptops, tablets or smartphones. Starting from these common characteristics, we analysed and tested the different programs in order to identify strengths and weaknesses of each one. Finally we decided to select Socrative.

Socrative is an application that allows interaction between students and teachers in an instantaneous way through activities that provide and immediate vision of the students' understanding. Additionally, the playful approach of this app encourages participation and increases student motivation.

Socrative was the program selected for our analysis, since it was the one that most adapted to our needs and our students' for several reasons. On one hand, it allows to create questions for the students in several ways: Multiple choice, True/False and/or Short Answer). On the other hand, it allows to carry out questionnaires by combining all types of questions (the 3 typologies marked above) with no time limit, showing whether each answer is correct and allowing the answers from the students to be anonymous or not. In addition, it allows to perform "competitions" individually or by groups (the latter was very useful for the motivation of the students). Moreover, it was only necessary students' devices in order to visualise the questions and answer to them. Finally, further analysis was facilitated by the fact that the results from each activity can be downloaded and reports can be sent which summarise students' answers in Excel format.

3.2. The questionnaire

The questionnaires were done digitally and had a playful approach. The use of ICT made possible to convert traditional tests into quizzes by creating a very different atmosphere from usual exams. In addition, ICT made possible to compile data and compare reports, whose analysis allowed to establish the rhythm, the progress and the difficulties experienced by students throughout the school stage. This information is very useful for both students and teachers (Vivancos, 2013).

Each student used an alias composed of the first letter of his forename and their last name and a number (corresponding to the row where he/she used to sit in class). Moreover, at the beginning of each lesson a list was presented with the alias used by the students and the number of correct answers in the previous lesson, in order to motivate them and lead them to pay more attention in class and answer more right questions in the following questionnaire.

3.3. Measuring the evolution of learning

An initial diagnosis, a follow-up evaluation and a final evaluation were carried out to measure students' evolution. The realization of an initial diagnosis about the students' knowledge allowed the teacher to design and plan the lessons with a greater emphasis on those aspects in which the students presented greater difficulties. In addition, it allowed to detect the lack of knowledge about concepts that students should know (explained in previous courses or in high school) and, therefore, it allowed to build the knowledge on a solid base based on the understanding of basic aspects that became increasingly complex. In order to conduct the initial diagnosis, a questionnaire was designed with basic and general questions related to Topic 4 of the subject of Geography of Europe entitled "Recent Economic Processes in Europe". This questionnaire was given out to the students in the class prior to the beginning of the subject in question.

The follow-up evaluation allowed the students to verify their own progress and the teacher was able to check the degree of knowledge acquisition by the students in a constant way and to pay more attention to those aspects that presented greater difficulty for students. Moreover, periodic tests, even if they had a superficial approach, could contribute to increase students' motivation and increase their performance (Rinaudo et al., 1997). The follow-up evaluation was carried out at the end of each class and consisted of a short questionnaire with questions related to the aspects discussed during the session. Those issues that obtained a higher percentage of error were explained again at the beginning of the next session.

Finally, at the end of the thematic unit 4, a final evaluation was conducted with the issues addressed throughout the development of the thematic unit. In addition, a test was also

carried out for students to express their opinions about the implemented activities during the thematic unit 4 in order to know their preferences and which activities were most beneficial to them in the learning process.

4. Results

The different tests allowed to measure the evolution of students' knowledge according to the row that they used to occupy. It is worth mentioning that the classroom never had full capacity and that the students did not complete all the rows. For this reason, the results are grouped in front rows (rows 1 and 2), intermediate rows (rows 3 and 4) and rear rows (rows 5 and 6).

A first analysis of the results showed that the proposed methodology was able to increase students' performance in relation to their starting situation. The results demonstrated that students' performance is inversely proportional to the order of rows they occupy during classes. As it can be seen in Table 1, the worst results obtained in the initial test correspond to the rear rows, while the highest scores are obtained in the front rows. These results confirm one of the first hypotheses, since generally the most motivated students sit in the front rows, while the rear rows are occupied by students with a minor interest towards the subject or to the methodology of the lessons.

Table 1. Average results by groups of rows (score over 100) and variation between the initial and final questionnaire

Rows	Initial Test	Final Test	Variation between both test	Variation between front rows and others (Initial test)	Variation between front rows and others (Final test)
Front	75,86	83,86	8	-	-
Intermediate	72,5	81,78	9,28	7%	2%
Rear	67,13	80,25	13,13	12%	4%
Total	71,65	81,88	10,22	19%	6%

Source: own elaboration.

The analysis of the results also allowed us to verify that after the application of the proposed methodology the rows that experienced a greater progress with respect to the initial test were the rear rows thus confirming another of the initial premises. The students in the rear rows obtained the worst results both in the initial test and in the final test, but after using the proposed methodology they were the students who made a greater progress compared to the initial situation, obtaining results which were very similar to those of the students in the front rows (Table 1).

Another of the objectives of the study was to know whether the teaching techniques or the practices used throughout the thematic unit contributed to the motivation and learning of

the students. Based on the information gathered in the student opinion survey, 86% of students preferred theoretical-participative classes versus purely theoretical classes. 87% of the students valued between positive and very positive the use of new technologies in the classroom and 68% of students affirmed that they felt more motivated during the development of thematic unit 4 (Figure 1). In addition, 87% valued positively the use of ICT in the classroom.

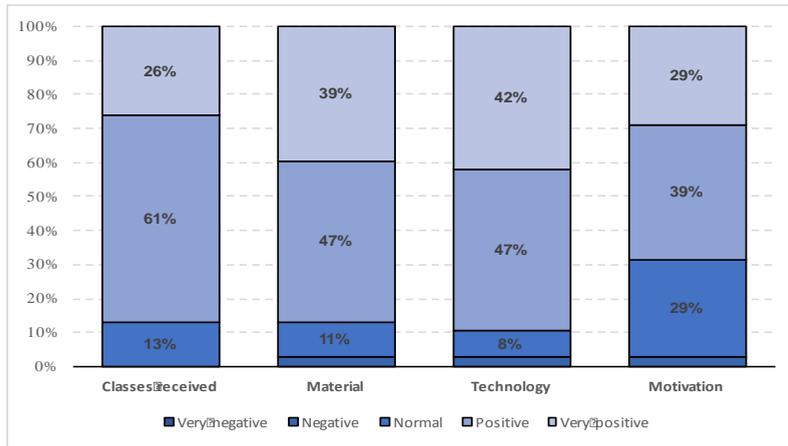


Figure 1. Student evaluation regarding the methodology and material used in class. Source: own elaboration.

As shown in figure 2 according to the students, the materials which they acquired greater knowledge with are the individual tests at the end of each session (32% of the students), followed by the master classes (27%) and the viewing of documentaries and teamwork (16%); they learnt less with the debates (-17%) and the readings and teamwork (-17%).

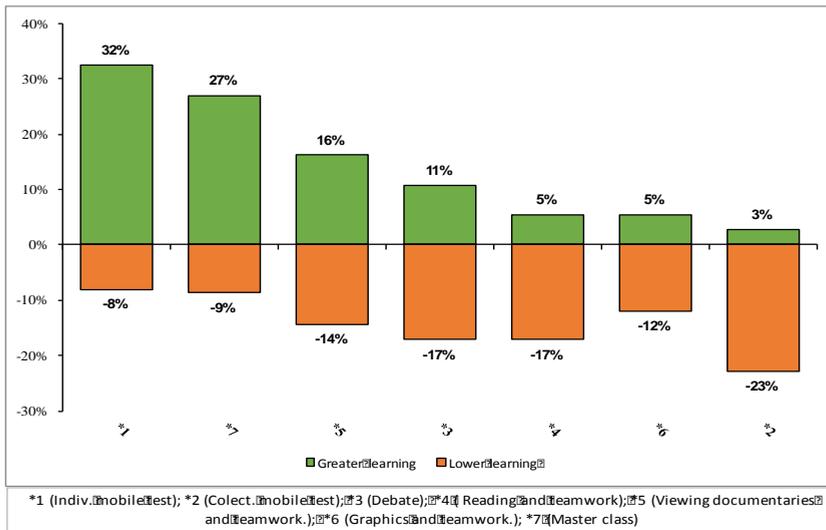


Figure 2. Assessment of the students of the techniques used in the classroom according to their learning: own elaboration

5. Conclusions

The theoretical-participative classes, the introduction of gamification, and the use of ICT in the classroom are proved to be positive for both teachers and students who have participated in the present study. On one hand, teachers were able to obtain immediate information about the level of knowledge and the difficulties of their students, making possible to reorient the theoretical sessions towards those concepts that presented major problems. On the other hand, the use of ICT and the gamification approach of some of the exercises improved the motivation of the students towards the subject, especially in those students who started with a lower level of knowledge. Finally, given that the present study is a pilot study, it is considered interesting to carry out a more exhaustive investigation (different courses, different grades, different classes), in order to verify the transversality of the statements made here.

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An Action Day for First-Semester Students, fostering Self-Reflection, Networking and many other Skills

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Abstract

Over the years, we observed that students have difficulties when moving from school to university. In order to support our first-semester students, we designed and performed an action day at the beginning of their first semester. This day is designed to create identification with the subject, to get them actively engaged, and to let students get in contact with each other in an unstressed atmosphere. Furthermore, we intend to assess students' initial level of competences relevant for studying successfully. The first four applications achieved good results. Passive students turned to a more active attitude, as they understood that they are responsible for their academic success right from the beginning. In a survey the majority of students agreed that the action day helped to get in contact with their fellow students. Interviews with lecturers confirmed this statement. Moreover, through the assessments, lecturers get insights into their students' competences at a very early stage. This helps to adjust the teaching to students' needs or offer additional support to them. Taken together, we designed an approach that offers our students a better start into their life at our university and we will continue performing this action day.

Keywords: *First-semester students, engineering education, competences, socialising, assessments, university entry-phase.*

1. Introduction

For a number of years, many lecturers have observed that students struggle during the first semesters of their studies. Nevertheless, the reasons for these struggles are still not clearly understood. As a consequence, lecturers are unsure of how to best support their students.

To improve the situation, we designed an action day for our students that takes place right at the beginning of their studies. During this day, we involve students in project tasks that create identification with the subject of their studies, and get them actively engaged at the same time. In between, we incorporate two assessments that evaluate initial competences that are relevant for successfully studying Computer Science or related topics. Thus, we help students to become aware of what it takes to study successfully (according to Thurner (2012)), and to assess how well they are set up for this task.

So far, we applied our action day concept four times, achieving good results. For example, students that participated in the action day adopted a more active attitude in their studies, accepting their own responsibility for the success of their studies at an early stage of their study process. As well, observing students throughout the action day and analysing assessment results helps lecturers to quickly understand the existing skills in their cohorts as well as issues where students need more specific support.

2. Goals

Many difficulties that students are confronted with when moving from school to university are caused by the different understanding of *education* and *learning processes* that prevail within these types of institution. For example, while schools in Germany mainly focus on learning facts and processes by heart, universities focus on deep understanding and problem solving abilities. Furthermore, schools provide precisely defined activities that students are supposed to follow, closely following instructions and not deviating from these well-trodden paths. In contrast to this, universities expect students to identify and organize their own individual way of learning and practicing, thus studying actively rather than “being studied” by the lecturers. As a consequence, students that were well adapted to school do not necessarily possess those key competencies that are relevant for successfully studying at university. Thus, we aim at making students aware of these study requirements and their own initial skills, right at the beginning of their studies.

Furthermore, we want to provide a setting where students can easily get into contact with each other, building teams and creating networks right from the start. Being well connected socially within the student group helps students to cope with the challenging demands of the study process and thus has a positive impact on both motivation and retention. As well, the first days of their studies should be intense and interesting at the same time.

3. Related Work

In a first step, we evaluated existing study-entry programs and analysed both their benefits and their limits. Then, we designed two assessments that provide insight into our first-year students' initial competences. Finally, we combined these two approaches into an action day for first term students.

3.1 Various study-entry programs

Many other universities world-wide try to increase students motivation, foster socialising and to reduce deficiencies in specific knowledge areas, in order to reduce drop-out rates right at the beginning. Almost all attempts in this area are time consuming, thus reducing lecture time, which in turn diminishes the willingness of lecturers to participate in such an activity with their students. Additionally, these concepts often need a large staff including experienced lecturers, which are harder to recruit than student tutors.

Some entry programs such as Reith (2015), Rothe (2015) and Standridge (2016) combine lectures and small projects, with a duration from several days up to the whole first semester. Usually, these programs aim at connecting theoretical input and its practical applications, as it will occur later on the job.

Another approach was developed by Diehl et al. (2016) at OTH Regensburg. As their *freshmen seminary* takes place on the afternoon of the first day of studies – traditionally the only free time slot of first-year students – they minimize the “loss of lecture time” to zero. This program attempts to support transition from school to university, enable students to detect knowledge deficits on their own, initiate socialising as well as recap study regulations and deadlines. To achieve this, they employ self-reflection techniques, requiring students to write down their own targets, expectations and important results. However, this approach does not scale well. Hence, in a second run the organizers switched to a test form on learning behaviour in order to evaluate the individual learning type. Furthermore, they incorporated discussion groups, a presentation and a maths test. At the end, students are provided with a handout on self and time management strategies, and evaluate their success in small groups.

Another, fundamentally different approach was developed by Carnegie & Browne (2014) at Victoria University of Wellington. They strove to develop an engineering culture, revised and created lectures and established a so-called *pastoral service*, accompanying students for several semesters. Through all these attempts, they significantly increased their students' retention rate in the engineering programs. Note that the pastoral service had a high impact on this success, as the pastoral care agent uncovered “barriers to student performance and (at times) [was able to] physically accompany them to the appropriate form of assistance”.

3.2 Assessing First-semester Students' Competences

In 2013 we developed a *self-assessment* Zehetmeier et al. (2014), which focusses on competences necessary to study Computer Science successfully. The test layout is based on the complementary estimation aid (KEH – Komplementäre Einschätzungs-Hilfen) developed by Eberle (2007). Competences we investigate into originate from Thurner (2014). Additionally, we developed a *knowledge test* Zehetmeier (2017) to get to know our students' initial level in important areas like basic math, computer theory and practice as well as several cognitive competences.

As well, we developed the skill profile of a model-student, which is based on a survey among lecturers in first-semester Computer Science courses on their expectations by Thurner et al. (2012). Combining model-student and self-assessment, we report to individual students how their current skill profile relates to lecturers' expectations. As well, we provide lecturers with an insight into their cohorts' competences.

4. Organisation

During our action day, which usually takes place in the first week of studies in winter semesters, we integrate the assessments described in section 3.2 into a series of team challenges, such as STOP WATCH, MAGIC CARPET, MARBLE RUN and MAKING A KNOT. Furthermore, we integrated three slots (welcome, competences during your studies, closing) where lecturers present their expectations, useful hints and their view on what it takes to study successfully. Table 1 provides a detailed schedule. Note that we try to alternate theoretical input, assessments and socialising, thus keeping a balance between the different types of activities.

Duration	Activity	Place
15 min	WELCOME	Lecture room
15 min	STOP WATCH	Open space
15 min	MAGIC CARPET	Open space
45 min	SELF-ASSESSMENT	Lecture room
15 min	BREAK	
15 min	COMPETENCES DURING YOUR STUDIES	Lecture room
30 min	MARBLE RUN	Open space
75 min	KNOWLEDGE TEST	Lecture room
25 min	MAKING A KNOT	Open space
5 min	CLOSING	Lecture room

Table 1. Schedule of the first-semester action day.

Most of the entry-phase programs are time and staff consuming. We tried to minimize the required number of lecturers and found an approach that can be performed mainly with student tutors. Nevertheless, there is always one person e.g. from scientific staff, organising (room management, preparing material and tests) and being responsible for everything.

The action day also requires some post processing. For example, tests are evaluated automatically and individual feedback is generated. Each student receives a PDF, showing individual results compared to lecturers' expectations. Furthermore, every lecturer receives an overview of his/her student cohort. This has to be prepared by the scientific staff as well.

5. Elements of the Action Day

Throughout the action day, tests are embedded in both theoretical input and team challenges, which we describe in the following.

5.1 Theoretical Input

As mentioned before, universities focus on other learning objectives than schools, addressing problem solving abilities rather than fact knowledge by heart. To help students to get aware of these differences, we explain the different types of tasks and learning objectives to our students, in terms of the revised Bloom's Taxonomy by Anderson (2001). This approach is continued throughout the first two semesters, e.g. in the lab assignments.

The main goal here is to increase awareness that various types of skills and tasks exist, each of which requires different ways of learning. First-semester students are usually very good at learning facts by heart. However, this is not what lecturers expect of them in the end-of-term exams. As specified in Thurner (2016) only 10% of the exam questions ask for terms and definitions, as some sort of warm up to the exam. After that, the vast majority of tasks involves skills on higher Bloom levels, such as understanding a topic or choosing the correct approach out of several processes that would solve a given problem.

To create this awareness is a main goal of the theoretical input of this first-semester action day, which is primarily provided in the section **COMPETENCES DURING YOUR STUDIES**.

5.2 Team Challenges

As researchers like Harris (2006) and Barefoot (1993) have shown that a feeling of togetherness can influence student retention in a positive manner, we integrated four team challenges into the action day. In order to increase the number of fellow students each student comes in contact with, we randomly create a new team for every challenge.



Figure 1. Name tag

To achieve this, we generate name tags (cf. Figure 1. Name tag) for the students. Underneath the name, each tag shows four symbols representing the four challenges. Posters showing a single symbol each are distributed in the open space. At the beginning of challenge n , students assemble at the poster that depicts the n -th symbol on their name tag. Thus, teams are newly assembled for each challenge.

5.2.1 Stop Watch Klee (2006)

In this challenge, the group of students forms a circle. One student receives the stop watch and talks about school background, weaknesses and strengths (often regarding subjects), hobbies and much more for 45 seconds. Then, the student hands the stop watch to the next person on the right, who in turn speaks for 45 seconds, and so on, until every student introduced him-/herself. Thus, students get to know fellow students and start to talk to each other. Furthermore, this shows students' expressiveness, self-assuredness and also humor.

It is important that every student speaks exactly for 45 seconds. Supervisors need to encourage shy students to speak, for example by giving hints for topics or asking questions. Additionally, they have to interrupt students that talk too much.

5.2.2 Magic Carpet

The magic carpet is represented by a canvas (approx. 1 m² for 5 students). The game is applicable for up to 15 students and exhibits capacity for cooperating, teamwork and systematic thinking. All students of a team start standing on the canvas, which is spread on the floor. They are told that they had an accident while flying across the Atlantic Ocean on their magic carpets, so that the carpet is now flying upside down. In this position the carpet cannot accelerate and starts to drop slowly. In order to reach the land, the team needs to turn the magic carpet around. However, you cannot step from the magic carpet, as you will fall down into the sea. So the task is to turn the canvas around, without "falling off".

The supervisor checks that all students remain on the canvas at any time. If not and if it is a small offence (e.g. brief touch of the floor) the student gets a handicap, for example an inflated balloon that has to be carried between the knees. In case of a big offence the punishment can go up to starting the process again. Supervisors should not be too critical during this game as it is more about having fun and communicating, rather than winning.

5.2.3 Marble Run

This challenge is all about creativity and teamwork. Every group of at maximum 8 students receives 4 DIN A3 and 6 DIN A4 sheets of cardboard, 2 glue sticks, 2 scissors and 3 marbles. The goal is to build a marble run that fulfills the following requirements: Robust design, self-supporting (not adhered to floor or wall), attractive design, group symbol integrated, well-defined finish, marble must run independently (only start impulse is allowed), marble must only run on the marble run (floor is not part of it).

Marble runs are rated according to the run time of the marble. Students have three trials, where the best one counts. If the marble gets stuck in the marble run, the run time is set to zero. Run time can be stopped while all students stand around a marble run. This increases the team spirit. Afterwards, the organiser prepares a ranking for the closing session.

5.2.4 Making a Knot

Making a knot demonstrates teamwork, conflict resolution, willingness to follow instructions and decisiveness. The game can be conducted with 6 to 16 students and varies in time. Students stand in a semicircle holding a rope with both hands. They now have to reproduce a knot that is shown to them, without letting go of the rope or letting the rope slide through their hands. Students are not allowed to touch the given knot.

6. Evaluation

Two months into the semester and thus two months after the action day, we conduct a survey among our first-year students. In this questionnaire, the majority of students agree that the action day helped them to get into contact with other students. Additionally, lecturers report that students are socially connected in a more intense way than before we started our action days. Furthermore, we observe that students that attended the action day flock together in study groups right from the first lecture.

We received much positive feedback on our assessments. Students appreciated the self-reflection process initiated by the assessments. Colleagues appreciated the results as highly informative and helpful Zehetmeier (2014).

7. Summary and Future Work

In order to offer our students a better start into their new period of life at university, we designed an action day for first-semester students. The single activities of this action day can be used separately, but display the best effect when carried out together.

Positive feedback from students and lecturers shows that the action day increases student retention. At the same time, our approach is customisable, requires only few lecture hours and involves a minimal number of professional staff.

We started to develop other activities focussing on the later profession of the students, like a project simulation Thurner et al. (2015). This is another important step to help our students to reflect on and identify with their chosen course of studies.

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Internationalization and Digitalization in Engineering Education

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Abstract

Digital, virtual and E-learning elements have increasingly become a part in higher education and, most recently, the high potential of digitalization for processes of strategic internationalization of higher education institutions is coming into focus.

The collaborative project of three German universities, ELLI – Excellent Teaching and Learning in Engineering Sciences, is working on strategies for the internationalization and virtualization of engineering education. While these topics used to be different key areas of the project, a combination of both distinguished itself as a potential new working field.

This paper introduces two pilot concepts that were implemented and evaluated at TU Dortmund University and Ruhr-Universität Bochum (RUB) which both aim at the complementation of incoming students' experiences in Germany by digital means. In Dortmund, a transnational online class explores means of preparing degree-mobile engineering students from all over the world for their master's studies in Germany. At RUB, an online course was designed to accompany a summer school research exchange for US-American engineering students in order to prolong their short-term mobility by digital elements.

These pilot projects were well-accepted by students and faculty at both universities and their evaluations between 2014 and 2017 have revealed valuable results for further optimization. This paper presents the results and discusses future potential.

Keywords: *Digitalization; Internationalization; E-learning; Virtual learning; Remote Labs*

1. Introduction

Since e-learning found its way into higher education institutions, there have been discussions about whether the increasing digitalization might present a threat to the physical nature of universities. Especially when massive open online courses (MOOCs) became a hype around 2012, scepticism arose with regard to the didactical quality of online teaching in higher education (Siemens, 2013). Research on the digitalization of higher education usually concludes that, while e-learning poses a challenge to universities, these institutions have always been facing challenges over the centuries of their existence. Thus, the capability of adapting to a changing society belongs to their inert qualities and interaction between students and university staff and teachers – whether digitally or personally – will certainly remain a crucial educational experience for students (Amirault 2012).

Institutions such as the German Academic Exchange Service (DAAD) have long since recognized the high potential of digital and virtual elements for the internationalization of the German higher education system (DAAD 2014). As several efforts on different levels show, digitalization can play a crucial role for the internationalization of higher education institutions on an organizational level and of education practice on a pedagogical level. Just as the final report of the working group “Internationalization & Marketing Strategies” in the German Forum for Higher Education in the Digital Age claims: “Digitalization opens up new opportunities for the higher education institutions’ on-going internationalization. [...] In the context of educational practice the potentials lie in increasing the mobility of German students and in new ways for internationalizing the curricula.”(Hochschulforum Digitalisierung, 2016). Dr. Dorothea Rüländ, DAAD general secretary and chair of the group, concludes: “The widespread media penetration of higher education is already in full swing. The age of digital learning and teaching scenarios is giving rise to new value chains for HEIs – its global scope is being expanded, opening up opportunities for advancing the strategic internationalization of German HEIs. In this regard, internationalization is not an end in itself, but rather proves to be a central factor for increasing the quality of research and teaching” (Rüländ, 2017). The working group sees key potentials in preparing students online for future stays in abroad countries and in building international digital learning groups for putting virtual mobility into practice.

Project ELLI aims at improving the conditions of teaching and learning in engineering education. The cooperative project of three German universities started off in 2011, funded within the Teaching Quality Pact by the German Federal Government and States. To develop innovative teaching and learning concepts for tertiary education, engineering chairs are working together with institutions for higher education didactics. Based on the project’s success during its first five-year term, a subsequent funding was granted for 2016 until 2020. In a cooperation between two of the project’s four key areas – *Virtual Learning*

Environments and Remote Laboratories and *Globalization*, two pilot concepts were realized between 2014 and 2017 which combine international teaching formats with digital elements. The following sections will introduce both concepts and the experiences of project coordinators.

2. Preparing students for international mobility

2.1 Using live online classes and remote labs for international engineering education

At TU Dortmund University, an online course was given to international students coming to Germany in advance of their stay. This course has been meant for preparing them for their future studies of an on-campus master program and at the same time exploring the potentials of live online classes with the help of online conferencing tools and remote labs. From 2014 on the course has been taught as a 4-weeks online seminar and further developed in 3 editions (in summer each year) to over 70 engineering students from over 25 different countries; such as Brazil, Mexico, Nigeria, Egypt, Iran, India, Nepal, Russia or even South Korea. In order to prepare the students for their master program in Germany and based on our lessons learned from recent years, we decided to develop a special online course, which is delivered before the students leave their home country for their stay in Germany.

The course and its concept so far have been explained in detail in several publications (see e. g. May & Tekkaya 2016 or May et.al. 2016). In the following we will outline the main issues of this course in order to put it into the greater context of internationalization in the light of digitalization and the context presented in the second example later on.

As explained above the course is fully taught online with live-online meetings and the students are, at the moment of course delivery, spread all over the world, which makes it necessary to put a special focus on time zone differences. We solved this problem each year in given the course twice, one time for the more western situated countries (from Brazil to Iran) and one time for the far eastern countries (like India and China). Even if this leads to a decrease in terms of cultural diversity we did not see any alternatives if we want to get into synchronous interaction with the students. For in-class interaction we are making use of Adobe Connect, which is a tool for online conferencing and, hence, can be used for class interaction, too. Using this tool we were able to design online classes very similar on-site classes. Hence, we used the online tool for lecturing, group interaction, and group presentations. For these presentations smaller student groups had to work apart from the live class meetings on several topics and prepare presentations. The topics to present on were chosen so that intercultural discussions in the smaller groups were necessary in order to share and compare different opinions cultural viewpoints. For example the students are

discussing different mobility concept for mega cities from technical, cultural and organizational perspectives. Furthermore they are asked to consider if the different concepts found all over the world would fit in their home countries' context or not.

Furthermore, and this is an unique feature of that online course, we are making use of an online remote experimentation equipment developed and put into practice here at the engineering faculty at TU Dortmund University. The remote laboratory offers the occasion to perform tensile tests, a core experiment in manufacturing technology, from a distance. The physical existing experimentation equipment can be accessed online and results are displayed in a web-based graphical user interface. Using the lab students can access the experiment and analyze the gained data from virtually every place in the world. We used the system in context with the displayed course in order to build up transnational distributed working groups and letting them work in teams with the equipment. For us this is a perfect opportunity to give the students the occasion to work in an international context, share different approaches in experimentation practice among each other and do real-life engineering work in an online environment.

Summing up, the 4 –weeks online course is split into three main parts, each focusing on different main aspects. In each week we have two live online meetings with homework to be done in-between. In the first part, the local and cultural orientation, the students are introduced to the local culture of Germany and the area around Dortmund. Furthermore we are making first steps in reflecting the own cultural background in context with engineering practice, so that the students can compare these cultures later on in that course. In the second part, the global orientation, the students are asked to discuss technology with their own cultural background in mind and compare their viewpoints. Therefore they are working in culturally mixed teams and discuss technical, organizational and cultural aspects of the above mentioned mobility concepts. The last part, the technical orientation, is dominated by a car-body design task. For this task they perform the experiment, again in mixed groups, and use the experiments' results for designing a defined part of a car body.

2.2 Benefits of preparational online courses and remote labs

Little time after course completion, the students are coming to Germany. Apart from the advantages that they were working online in international teams and that they already know their destination more in detail, another benefit of such a preparational course is that the students already know each other. Whereas we experienced in former times that especially in an international study programs students are tending to build mono-cultural peer groups we received the feedback with this online course that the students now are working more likely together in mixed groups, even during there stay in Germany. Another positive aspect mentioned by the students is the opportunity to get to know their future destination in advance and prepare them for a cultural clash. From our perspective as engineering teachers

the opportunity remote labs open up for international education are tremendous. So far online courses had the difficulty that hands-on engineering work could not be done in such online context. Even if it always has been possible to work on engineering tasks even in distributed groups (for example with the help of simulations) it now makes a significant difference using physically existing equipment and knowing that real experiments are part of the students. This is what the students, asked for their favorite activity during the course, mentioned, too. They were both impressed and motivated by the fact that they were using the very same equipment they would be using for laboratory courses during their stay at TU Dortmund University. Even if there remains a lot of research to be done in terms of effectiveness and advantages for the learning process of remote labs in comparison to on-site lab work, we do see high potentials in this technology for the internationalization of engineering education with the help of digitalization.

3. Enhancing a summer school format by digital elements

3.1. Setting up a student exchange in engineering between the US and Germany

While for German engineering students the US rank as the top destination country for a student exchange (DAAD 2013), their counterparts' interest in coming to Germany for a period of study is not equally great, with other English speaking countries such as Great Britain or New Zealand ranking among their top destinations (Bhandari et al. 2013) To circumvent mobility barriers such as different semester times and language difficulties, summer school formats that are taught in English seem to be what US-American students prefer (Schubert 2013).

Seizing the potential of its process technology laboratories, the faculty of Mechanical Engineering at the Ruhr-Universität Bochum (RUB) established a cooperation with the department of Chemical Engineering at Virginia Tech University in Blacksburg. Since 2015, 15-20 students can be exchanged per year, American undergraduate students coming to Z for two months during the German summer semester, while German students spend the spring term of the following year in Virginia. At RUB, the American guests take part in the laboratory process technology for 8 weeks and work on individual research projects supervised by a researcher in groups of two. Additionally, they have 60 hours of German classes at the level A1, for most of them come without prior knowledge of German.

The short-term nature of the program seemed to be the best option to circumvent the different semester times of both countries and at RUB, faculty members made a great effort to be able to offer such a compact program with contents in English while most of the regular curriculum is taught in German. However, evaluations of the 2015 pilot run revealed that students – albeit generally appreciating the program – were unsatisfied with

the little contact they had with German students during their stay here and stated that they would have liked to be better prepared for their stay in Germany. Apparently, a deeper immersion into German academic culture was made difficult by the summer school (short-term and English speaking) nature of the program. Reacting to those needs, the project ELLI together with the Faculty of Mechanical engineering took to designing an accompanying Webcast and E-learning format which was first tested during the second year of the student exchange, from January to August 2016.

3.2. Accompanying the summer school with Webcasts and E-learning elements

With the aim of prolonging the short physical stay for international students who come to Bochum only for two months, the project ELLI decided to enhance the exchange program by digital elements. As a framework for the preparatory course, the project used the E-Learning platform Moodle to set up an online course which contains four sections:

The first section gives an *Overview* of the setup of the exchange program and the accompanying E-learning elements, as well as all persons involved. A *Calendar* is updated regularly with all important dates regarding classes and research projects, but also excursions and official get-together meetings. As the platform is also intended as a first opportunity for everybody involved to get to know each other before meeting in person, the *Contacts* field contains short profiles describing students, teachers, and organizers. In cooperation with the university's center for foreign languages (ZFA), a section for *Learning German* was included, where a preparatory moodle course by the ZFA is linked which provides 12 E-learning units of German A1. Thus, the students could start learning the language at least a little before coming to Germany. The section *Research* introduces students to the process engineering laboratory environment and respective supervisors of their upcoming research projects. At the same time, supervisors could make use of this platform in order to get to know their future students early on and provide information about their research. Another important aspect was to prepare students early on for their work in the laboratories. Therefore, documents with *Safety Instructions* for the university's lab facilities were provided that had to be read by students before starting their actual work in the labs. A video was produced especially for this purpose deals with the safety regulations of the institute and shows what to do in emergency situations. For the fourth category, *Social*, the project produced *Video Clips* (each about 3 minutes long) which introduce the host university with its campus facilities and the engineering faculties, as well as the surrounding cities and possible free time activities. The videos contain useful practical information such as how to print the semester ticket and get to RUB from the airport by public transportation, or how to use the university and faculty libraries. The moodle course and its contents were introduced to the US-American guest students in two *Webcast_Sessions*. The sessions, which were run via Adobe Connect, served as a first opportunity for students and organizers to get to know each other and to answer important

organizational questions. They were accompanied by the supervising university teachers on both sides.

Starting with the webcast sessions in January, the total length of the program could be stretched from a mere two into almost seven months – a prolongation that had a positive effect on students' perception of cultural immersion: While in 2015, they had rated this aspect very low, 2016 participants rated the program “very helpful” in terms of experiencing academic and cultural exchange. As only 8 American students came to Bochum, the high effort put into designing the course by university staff could be regarded as disproportionate. However, the experience shows that with the additional support of a project such as ELLI, a faculty or chair can establish a digital structure (moodle course, videos) that can easily be used again for other exchange programs with only little adjustments. Thus, the pilot run can be seen as a clear benefit to the exchange program and will be built upon during the years to come.

4. Conclusions and Outlook

The experiences of both projects presented in this paper show that - provided they comply with the quality standards of higher education – digital educational offers can support and promote international experience. While they can certainly not replace study periods abroad, they can be used in order to prepare students and teachers for different academic cultures and to give introductions to the languages and subjects of host universities.

With a special focus on engineering education, the possibilities that remote laboratories offer in order to provide hands-on experience for international students even without being on site in Germany became obvious. With regard to the problems student exchange programs often face due to different semester times, it was shown that accompanying digital formats can serve to make a stay in Germany more attractive in terms of cultural immersion for incoming students. A relatively high effort is required in the starting phase of such programs, as digital structures have to be built and their application needs to be tested and internalized by teachers and students. However, once the new digital frameworks have been established, they can increase exchange activities on both sides, at home and abroad, and prepare international students for their studies in Germany.

During its second funding phase, project ELLI will continue to develop measures that combine digitalization and internationalization in engineering education: Transnational education approaches will be enhanced and linked to remote laboratories. The central goal will be to allow for students to strengthen their intercultural competences while working on real engineering and technical problems, in online courses where they can conduct experiments, analyze and interpret their results in international teams.

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What if students propose their own examinations? An introductory experiment

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Abstract

This paper presents a proposal experimented in the University of Burgos, where students of different degrees, at a Bachelor or Master level, had to prepare solved questions or exercises, in order to introduce some of them into the exams. There were considered three types of experiment: test, short questions and exercises. Students submitted they own proposals into forum, where the teacher corrected them and randomly selected some of them, which configured the half of the official exam. The obtained results were very positive: students had a very good perception of the experiment, learnt more and passed the subject easily. Also, the average grading were higher that the corresponding with the classical system, existing a slight correlation between this increase and their point of view about the chance to learn. The satisfaction and the marks of the students are higher, while having a better knowledge of the topics included. Also, students have the feeling that the teachers are more considerate and thoughtful with them, so this type of experiments should be continued.

Keywords: *Grading; Students participation; Questioning.*

1. Introduction

Students, in general, tend to complain about the difficulty of tests, questions or exercises suggested by their teacher on exams. In some cases, it is the wording of the question that causes the problems, because the students do not understand what the teachers are asking them. All these circumstances are considered one of the causes of their low rating. Therefore, the authors have tried to change this situation, allowing students to prepare part of the exam, in a university setting.

We do have to be concerned that the old ways of teaching can be changed. Our students are different and need different strategies to connect them with the topics included in class (Biggs & Tang, 2007; Ramsden, 1992). So we have to adapt our techniques in order to find ways to encourage and involve them in the learning process.

When analyzing the existing literature, Rosenshine et al. (1996) and Cano García et al. (2014) developed some experiments in which students were taught to generate questions about ways to improve their understanding. Hardy et al. (2014) introduced an online tool to facilitate learning, where students sent multiple-choice questions, with very good results. In fact, question-generation has been considered as a technique of training in metacognitive knowledge by different authors (Cano García et al., 2014; Wright, 2001; Chin & Brown, 2002).

Ryan & Deci (2000) formulated their theory of self-determination, which describes the effects of external events on motivation. If these events promote the belief that the person controls the results and encourages a sense of competition, the intrinsic motivation will increase. If these events favor the perception of incompetence and lack of control, the intrinsic motivation is weakened. Nicole and Macfarlane-Dick (2006) focused on the same idea, noting that research on formative assessment and feedback can help students take control of their own learning, becoming self-regulating learners.

Hence, in this paper we are looking for a tool that will allow students to become more involved in the teaching process, improving their motivation and their effort to achieve a deep learning in our subjects. In this case, we allow them to prepare part of the exam, so that, in some way, control the learning and qualification process.

The paper will be divided into four sections. The first section presents a brief introduction to the topic. Sections two and three describe the followed methodology and its practical application to a case study at the University of Burgos (Spain); the discussion and the analysis of the results are also shown. Finally, the main conclusions are presented in section four.

2. Methodology

This paper presents an experiment developed at the University of Burgos (Spain), where students had to propose test or short questions and exercises, on certain subjects, that would be introduced in their exams. All subjects were included in Engineering or Business Administration and Management Degrees, at a Bachelor of Master level. The complete list of subjects in which the experiment was developed is presented in Table 1 below.

Table 1. Subjects involved in the experiment.

Course	Subject	Year	No. students
Bachelor's Degree in Business Administration and Management	Analysis of Financial Operations	First	91
Bachelor's Degree in Civil Engineering	Transports	Third	28
	Urban and Intercity Traffic	Third	3
Bachelor's Degree in Mechanical Engineering	Materials Engineering	Third	46
Bachelor's Degree in Computer Science Engineering	Computer Equipment Maintenance	Fourth	14
Master's Degree in Civil Engineering	Transport Systems	Second	36
	Traffic Engineering	Second	10
	Highway Management Systems and Road Safety	Second	20

Source: in-home.

In each of these subjects, students had to prepare test questions, brief questions or exercises for the application of knowledge learned in class. Depending on the nature of the subject, one or more type of question / exercise was developed, with its corresponding response. Part of the subject's qualification was related to the quality of these questions: assessing their accuracy, correctness of the answer and coverage of the whole topic.

In order to allow all students to know the questions of their colleagues, several forums were opened, and each group of students had to present their proposal there. Repeated questions or exercises were forbidden, and students had to read first the proposals already submitted, so that the whole topic was covered. These elements were corrected by the teacher, who published the correct answer (if necessary) in the same forum.

Half of the exam of the related topics was done through questions / exercises prepared by the students themselves, and the rest was prepared by the teachers. In this way, we can see

the differences in the qualification between the part developed by themselves and the “classic” system.

Finally, after the exams, students were asked to respond to a survey of their experience with this type of qualification system. With this survey and their academic results, we can assess whether the new system is appropriate to these subjects or not.

3. Results

In this chapter, we analyze the results of the experiment. In the first part, the students' survey will be evaluated to know their degree of satisfaction with the new system. In a second part, we will compare the academic results (qualification) in both parts: the questions and exercises proposed by the students in the forums and those developed by their teacher.

3.1. Survey Results

As we have described previously, after the exam the students were asked to response an anonym interview, were they can express their degree of satisfaction with this system, and their personal opinion. In overall, 231 surveys were collected, which supposes a response index of the 93% of the students.

Among the different questions, included in this survey, we can note the next five ones:

- How have you studied with the new grading system?
- Do you think that you have learnt more with the new system?
- In which stage have you learnt more?
- Is passing the subject easier with the new system?
- Can you globally value the new grading system?

About the first question, we can note that most of students opted to study the whole material of the subject, having a look afterwards to the questions submitted to the forums. This issue is crucial for the remaining data, since the point of view of the students that only see the questions and exercises uploaded to the forum is different than the rest of their classmates. Figure 1 presents the results of this topic though the interviewees.

Concerning the second question, the results show that the 67% of students think that they have learnt more with the new system. However, those who only studied the uploaded questions/exercises had a lower value in this question than the rest (3.64 in comparison with around 4), so they had not the same degree of “exploitation” of the system. The results of the survey are presented in Figure 2.

If we analyze when they have learnt more, the results are different again depending on their way of studying. Those who only studied the submitted questions note that the process of preparing these questions and exercises was the time when they learnt more. On the other hand, those who studied the complete material appreciate that have learnt in a similar way in both processes. In Figure 3 we can see the numerical results.

In Figure 4 we present the results concerning the ease to pass. In general terms, 54% of students perceive that it is easier with the new system rather than the classical one. However, if we analyze the surveys per type of question, the averages rates of this issue are: 3.41 for test questions, 3.26 for short questions and 3.23 for exercises. Thus, the feeling of “safety” in the students is higher in the test experiments, where they have a certain degree of closed questions for the exams.

Finally, we asked them about their degree of satisfaction with the new grading system. The results are shown in Figure 5, where we can see that students are very happy with it, with an average value of 4.02.

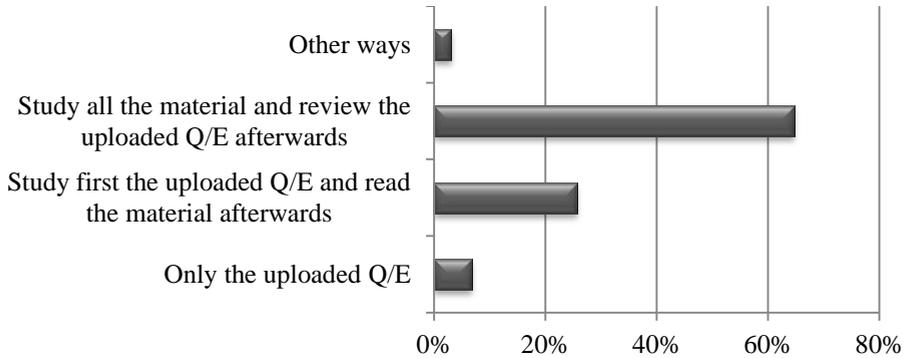


Figure 1. How students have prepared the exams. Source:in-home.

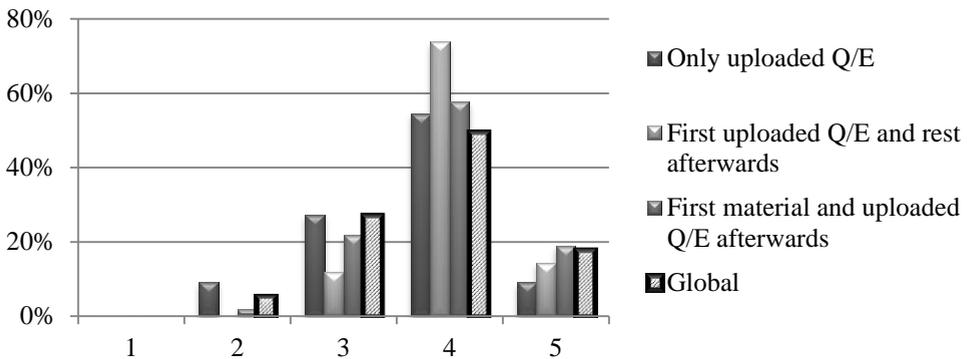


Figure 2. Students have learnt more with the new system (1 - totally disagree; 5 - totally agree), depending on the way that they prepared the exams. Source:in-home.

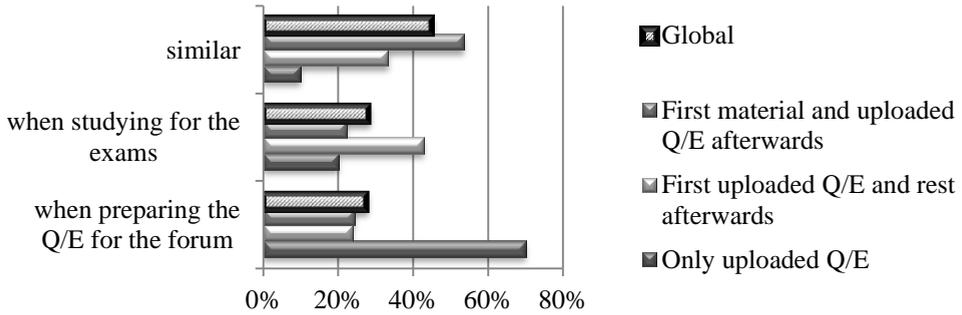


Figure 3. When did students learn more, depending on the way that they prepared the exams. Source:in-home.

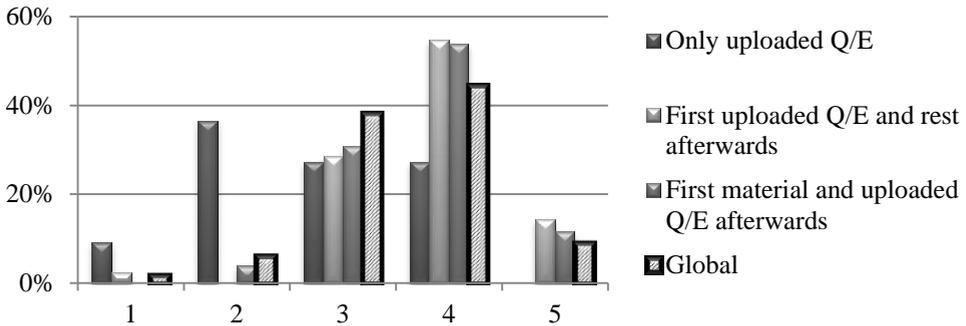


Figure 4. Passing is easier with the new system (1 - very much harder; 5 - very much easier), depending on the way that the students prepared the exams. Source:in-home.

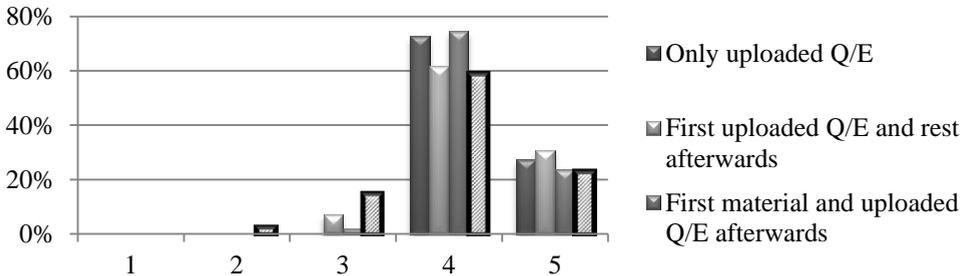


Figure 5. Overall satisfaction with the new system (1 - very bad; 5 - very good), depending on the way that the students prepared the exams. Source:in-home.

With these results, we can conclude that, even when all the students have declared that they “like” the new system and have learnt more this way, the degree of “exploitation” of it is not same for all of them. Some of them have really used to have a continuous learning during the term, while other only considered it an easier way to pass the subject. In the next section, we will assess if the valuation corresponds with a real improvement in the students’ grading.

3.2. Grading Results

In the survey, students have stated that they prefer the new system and that they have learnt more and passed easier with it, rather than the classic one, where teachers decided which questions or problems would be introduced in the exams. In this section, we will compare their qualifications between the half of the exam proposed by themselves and the part prepared by the teachers.

In the first part, we can notice the real improvement in the grading with the new system, if we compare it with the classic one. These results are shown in Table 2, for each considered subject. The presented grading was obtained in the same exams, but differentiating the questions or exercises prepared by the students (new system) and teachers (classical one).

Table 2. Subjects average grading (from 0 to 10).

Subject		Analysis of Financial Operations	Transports	Urban and Intercity Traffic	Materials Engineering	Materials Engineering (Lab)	Computer Equipment Maintenance	Transport Systems	Traffic Engineering	Highway Management Systems and Road Safety
Test grading (0-10)	New system				8.0	7.5	8.4			
	Classic system				4.3	7	7.8			
	Improvement				86%	7%	8%			
Short questions grading (0-10)	New system		6.0	7.2	6.4			6.3	8.4	8.5
	Classic system		5.2	5.5	5.8			5.5	6.5	7.3
	Improvement		15%	31%	10%			15%	29%	16%
Exercises grading (0-10)	New system	5.2	7.4	8.6					9.3	
	Classic system	3.8	5.2	4.9					8.2	
	Improvement	37%	42%	76%					13%	

Source: in-home.

Analyzing these data, we can see that there is an improvement in the qualification of the students in all type of exams, whereas the type of short questions is slightly smaller than the rest of experiments. The greater increase was obtained in the problems (exercises) exam.

4. Conclusions

In this paper, we present an introductory experiment on how to include students in the process of preparing exams, at university level. Asking the students a comprehensive survey, we have noticed that they were satisfied with the experiment, and they declared that they have learnt more by this method, because they had to read the whole topic to propose a good question. In addition, their scores have improved, in a different amount depending on the type of exam. However, we cannot forget that there are students who only read the questions and exercises from the forums, so they do not have a complete experience. This is a fact that the authors will try to change in future approaches.

Finally, we can conclude that this new grading system has resulted in a Win-Win strategy, as both students and the teacher achieve their goals: students are happier and mark higher, while having a better knowledge of the topics included. Perhaps this type of experiences, where students have a higher leadership of the whole process, is the future of the university academic teaching.

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Design, implementation and evaluation of an authentic assessment experience in a pharmacy course: are students getting it?

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Abstract

Authentic assessment has been a focal strategy in higher education as a way to provide students with engaging and meaningful learning experiences in preparation for the real world work environments. Possibly due to the lack of consensus in the elements that outline that authenticity, limited amount of authentic learning experiences are reported and evaluated in the literature. This study aims to describe and evaluate the design and implementation of an authentic assessment in a pharmacy undergraduate course. A five-dimensional model for authentic instruction was utilized in the design of the learning experience. This was complemented with an eight-element framework that contributed to create an authentic assessment. Two surveys explored subjective authenticity as perceived by students and stakeholders. The results revealed that students found it hard to value their performance at the higher level that stakeholders do. While the use of models and frameworks in the design of authentic assessment is valuable, academics' efforts need to be concentrated on further developing student's metacognitive skills in order to provide relevancy and value to the knowledge, skills and attitudes developed in undergraduate tertiary education.

Keywords: *Authentic Assessment, Authentic Learning, Pharmacy education, assessment design*

1. Introduction

The topic of authentic learning and assessment has been a strong focus of attention in higher education in the last two decades. (Ashford-Rowe et al., 2014; Meyers & Nulty, 2009) It is believed that authentic learning and assessment provide learners with engaging and meaningful learning experiences that connect their learning and performance to real world work environments. Theoretically, these experiences provide the students with conceptual connections that contribute to learner's readiness and employability in the work environment.

It is also essential to recognise that the design of authentic assessment requires a course approach and needs to be supported by a pedagogical framework that aligns with the industry expectations.(Ashford-Rowe et al., 2014) Higher education practice has been significantly influenced by the constructivist learning theory and the instructional design literature. (Biggs, 1996) This lines of thinking, are usually combined into one approach referred as "Constructive alignment" that brings together instruction, learning and assessment. (Biggs, 1996) (Gulikers, Bastiaens, & Kirschner, 2004).

Contemporary education approaches have focused on developing the skills and abilities of students, and these are often aligned with principles from Social Constructivism and Connectivism (Hunt & Chalmers, 2012). Work integrated learning (WIL) plays a crucial role in this teaching approaches and is internationally recognised as "a strategy for ensuring students are exposed to authentic learning experiences" (Ferns, Campbell, & Zegwaard, 2014). WIL experiences provide the students with the opportunity to apply theoretical concepts to practice-based tasks, ultimately enhancing graduate employability (Knight & Yorke, 2004) (Peach & Matthews, 2011).

Despite the extensive conversations about what makes an assessment authentic and the numerous frameworks that identify the critical elements of authentic assessment, there is not always consensus in the components that shape the authenticity of learning and assessment experiences. A thorough literature review carried out by Gulikers et al (Gulikers et al., 2004) identified three principles that grounded the design of a five-dimensional framework for authentic assessment. These principles highlight the importance of alignment to authentic instruction that influence student learning, demonstration of competences thought a valuable accomplishment and the acknowledgment of authenticity as subjective perception to the student. Recent work by Ashford-Rowe et al (Ashford-Rowe et al., 2014) outlined eight elements that are considered critical in the design of authentic assessment. These could be summarised as: i. Challenge, ii. Performance, iii. Transfer of learning, iv. Metacognition, v. Accuracy, vi. Fidelity, vii. Discussion and feedback, and viii. Collaboration.

Teaching and learning approaches used in pharmacy education in Australia have experienced considerable change over the past decade (Marriott et al., 2008). Current reforms of the curricula focus on the graduates acquiring not only knowledge but also the abilities, attitudes and skills that society demands as essential in healthcare professional (Blackmore & Kandiko, 2012). The development of competencies in the contemporary design of curricula promote an interdisciplinary and professional identity development (Langendyk, Mason, & Wang, 2016). Queensland University of Technology has established authentic assessment that is designed and evidenced at the whole-of-course level as a distinguishing feature of learning. As learners advance from introductory through to developmental and mastery levels, QUT course designs are encouraged to ensure that learners engage progressively with authentic assessment tasks and activities, supported by authentic learning and pedagogy across their learning journey. The review of a pharmacy curriculum provided the opportunity of reflecting on the implementation of authentic assessment and the perceptions of students and stakeholders. This study aims to describe and evaluate the design and implementation of an assessment supported by authentic instruction and a framework of nine components of authenticity in the context of a pharmacy undergraduate course.

2. Methods

The review of a particular unit in the pharmacy course provided the opportunity to design an assessment where students could demonstrate core professional competences within evidence-based practice focused on the patient care in order to solve practical and clinical problems in a real world pharmacy setting. In this particular unit, a strong focus was expected in research and communications skills. Students in the 4th year of Pharmacy in QUT are expected to further develop professional skills under the guidance of preceptor pharmacists with the aim of enhancing the understanding of the role of the pharmacist in providing healthcare products and advice to patients. Exposure to real life clinical scenarios in WIL activities was expected to further develop their analytical and problem solving abilities in providing both pharmacological and non-pharmacological healthcare solutions.

A backward design process (Wiggins & McTighe, 2001) was selected in the design of this unit and its assessment. A poster presentation as part of a health conference was identified as an appropriate demonstration of the targeted learning outcomes while still providing an authentic environment for assessment. Participating in scientific conferences are often considered an expectation in the professional life of clinicians, as these events provide a unique opportunity to disseminate knowledge involving visual and verbal communication as well as to demonstrate research skills and high order critical thinking.

2.1 Authentic instruction

Following the five-dimensional model for authentic instruction (Gulikers et al., 2004), the unit was designed components that safeguarded authentic learning goals:

2.1.1 Authentic learning tasks

Undergraduate students are not always familiarised with conference setting and “hands-on” research activities. Therefore the unit structure was divided in two parts, one where the students would interact with an experienced academic and scaffold their learning in preparation for the conference, and a second part where the students could carry out a small research project in a pharmacy setting as a WIL experience. Numerous tasks were developed during the first part of the unit to provide the relevancy and the value of this learning experience to the students. This included tasks like identifying health problems and relate them to available evidenced solutions, questionnaire and poster design, peer feedback and strategies for effective communication.

2.1.2 Authentic and social learning context

The combination of in-class collaborative interaction with on-field research data collection provided a safe learning environment but also reflected the way that knowledge, skills and attitudes were used in professional practice with relevancy to a health conference. It is widely recognised that collaborative learning is also an essential part of authentic learning (Herrington & Herrington, 1998), however, the independency and individual accountability of the learner also needs to be considered (Slavin, 1989) as uniquely discussed in the five-dimensional framework. Hence, an individual self-assessment of performance was encouraged as part of the WIL task with guidance from the preceptor on site.

2.1.3 Epistemology of the practitioner and authentic learning goals.

During the on-campus part of the learning, the academic facilitated activities that encouraged the critical thinking skill of the students in a research environment. In-class support from other specialised resources (database searches, software support for poster design and oral communication skills) was facilitated utilising the internal network of the university to support the students.

2.2 Assessment design and implementation

Within one week of completing the WIL experience, the students were asked to submit a research abstract to the unit coordinator. This resembled the usual abstract submission expected in scientific conferences and provided a connection to previous knowledge.

Those students assessed were expected to create a poster that highlighted not only their research but also a solution in the shape of a Health campaign or pharmacy intervention that contributed to solve the Health problem identified in practice. Each of the posters were presented in a digital format in a conference room followed by 15 minutes oral presentations from professional researchers in order to facilitate the physical and social context where research happens.

The assessment criteria explored the background research presented, the link with the health campaign ad level of understanding of the topic, the use of theoretical frameworks to the design, and the oral and visual communication of the content. Members of the pharmacy profession from hospital, industry and community settings were invited to attend to the conference and act as assessors of the posters.

2.3 Results: Evaluation of the assessment experience

Several authors highlight how the authenticity of an assessment is subjective to each student.(Gulikers et al., 2004; Honebein, Duffy, & Fishman, 1993; Huang, 2002). Hence it was important to explore the perceptions of the students and the assessors on the relevancy of this assessment in the career of a pharmacist.

2.3.1 Survey of students and stakeholders

A survey was designed to explore the perception of the students on the demonstration of research skills, relevancy of the skills acquired and the level of performance in this unit as well as their confidence on communicating with members of the audience. A similar survey was designed for the assessors, but this one also included a question about how confident they would feel when recommending the students for employment. The surveys were carried out online within a week after the event. Ethical approval to survey this sample of students and assessors was granted by the Human Research Ethics Committee in QUT.

Participation to the survey was voluntary. A total of 14 students (34%) out of 41, and 6 assessors (46%) out of the 13 that took part in the conference completed the surveys. Across all questions, students perceived a lower level of performance in the assessment and their demonstration of skills than that one perceived by the assessors (Figure 1 and Figure 2). This difference was particularly substantial in the relevancy of their skills but also in self-assessment skills (metacognitive skills). This was also apparent in some of the comments added by the participants: “*The enthusiasm and application of the students in*

presenting created an uplifting experience for observers and judges.” (Assessor A), “I am very impressed from the high performing cohort provided by QUT as future pharmacists.” (Assessor B), “It is a good day for networking” (Student A), “I didn't really think that it aided awareness of what employees are looking for.” (Student B)

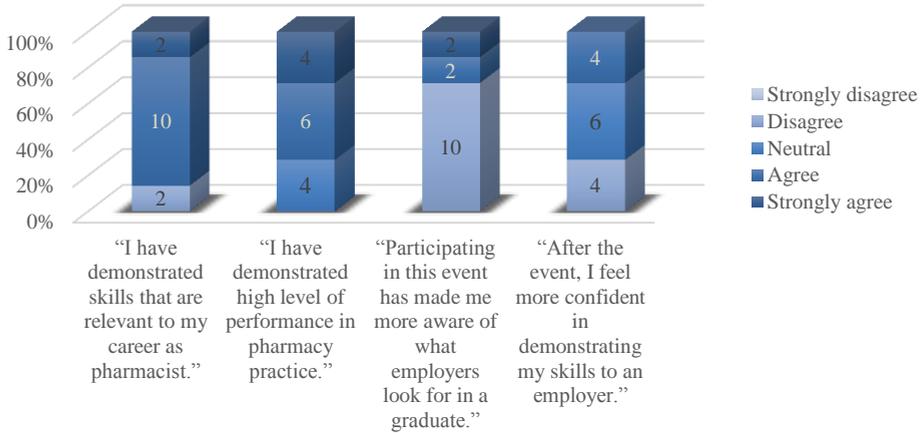


Figure 1: Students' perceptions on the authenticity of the assessment

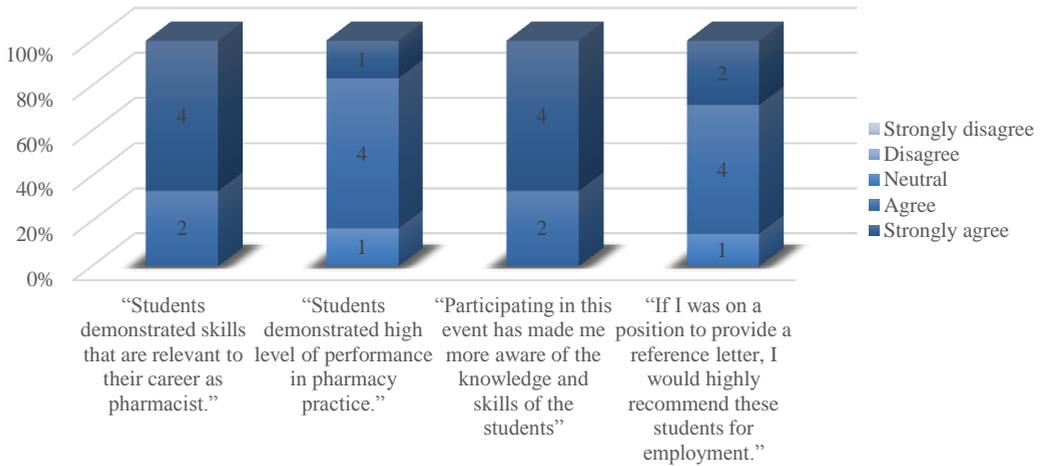


Figure 2: Assessors' perceptions on the authenticity of the assessment

3. Discussion

3.1 Challenging the students and their performance

As students progress through an undergraduate course, they face a variety of assessments that may challenge their performance. In this case, the task required the synthesis of a range of skills and information into the composition of an appropriate performance. The final outcome was core part of their unit and it shaped the authenticity of the instruction by facilitating those skills that are applied in a simulated environment. The student participants did not highly value the creation of a poster as authentic skills, in contrast to previous literature where students perceived the development of a final product as a valid determinant of authentic assessment. (Ashford-Rowe et al., 2014) This result can indicate the challenge found by the students when implementing authentic assessment, possibly due to previous instruction through traditional assessments based on behaviourist philosophies. (Merriam & Bierema, 2014; Westbrook et al., 2013).

3.2 Transfer of learning

While the transfer of learning seemed obvious for the assessors, it seems necessary to confirm to the learners the authenticity and relevancy of their knowledge, attitudes and skills that society demands as essential in healthcare professionals (Blackmore & Kandiko, 2012). Collaboration in interdisciplinary groups is also necessary to facilitate this transfer of learning. (Frenk et al., 2010; Horton, 2010).

3.3 Metacognition

Metacognitive skills were demonstrated through critical reflection and peer evaluation in the first part of the learning activities and through self-assessment during the WIL activity. While it is possible that time constraints or lack of experience may have compromised certain level self-reflection of their performance, the assessors believed in the authenticity and the relevancy of the skills demonstrated by the students. This fact indicates that academics should focus further efforts into developing the reflective skills of our students to advance their educational practice.

3.4 Accuracy and fidelity in a collaborative environment

The environmental context in which the assessment was implemented replicated with high fidelity that one of a public scientific conference. This was nevertheless constrained by the requirements of an assessment such as the essential attendance as well as by the shorter timeframes for preparation due to the limited amount of time between completion of the WIL activity and the assessment. While this case reported the experiences of a cohort of pharmacy students, this activity could be applicable to the majority of disciplines in tertiary education as it represents a measurement of performance in research and communication

skills in those industries where the stakeholders are also employers within than profession. The fact that external members of the pharmacy profession acted as assessors provided the students with the opportunity of a feedback session on their posters with the academic in charge of the unit as well as to obtain some feedback from their peers before the final presentation. This contributed to the collaborative nature of authentic assessment identified in the literature (Herrington & Herrington, 1998) which was already implemented during the first part of the learning activities.

3.5 Feedback and discussion in authentic assessment

The results from the evaluation of this assessment agreed with those principles outlined by Gulikers et al (Gulikers et al., 2004), and in particular with the subjectivity of authentic assessment from the perceptions of students. It is difficult to identify if the epistemological standpoint of the accuracy of authenticity belongs to those performing or those assessing, but this reform in assessment has emerged as an academic response to the demands of the industry and the need to equip graduates with the necessary abilities and leadership skills to face the challenges of workforce, such as working in interdisciplinary teams care (McLaughlin, Dean, Mumper, Blouin, & Roth, 2013).

4. Conclusion

While the use of models and frameworks in the design of authentic assessment is valuable, academics' efforts need to be concentrated on further developing student's metacognitive skills in order to provide relevancy and value to the knowledge, skills and attitudes developed in undergraduate tertiary education. This study has contributed to provide experiences and examples of how to implement authentic assessment in the class. The evaluation played a significant role in the iterative process of continuous review of curriculum and, hence, a comparison of the evaluation presented and future evaluations that reflected on these results could be very valuable to refine the authenticity and environment provided in this type of assessments. Further research incorporating focus groups or a larger group of participants would potentially benefit the interpretation of the results.

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Using open software to teach resource assessment of renewable energies

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Abstract

The students of the Faculties of Engineering of the University of Basque Country (Gipuzkoa-Eibar and Bilbao) in the last years of their studies, before becoming engineers, have the opportunity to select a block of subjects intended to enhance their knowledge on Wind Energy, Ocean Energy, Bioenergy and Hydraulic Energy. These subjects are devoted to different aspects of the water cycle management, and geographical representations of wind, ocean and Bioenergy energy resource. Apart from the transmission of good practices, the focus is practical and is based on hands-on computer real-life exercises, which involves not only intensive programming using high-level software, but also the spatial representation of results. To that purpose three main open source codes are used: EPANET (<https://www.epa.gov/water-research/epanet>), QGIS (<https://www.qgis.org/>) and R (<https://www.cran.r-project.org/>). Students learn how to address real-life problems regarding the correct calculation of water distribution networks with EPANET, geographical representation of wind and ocean energy resource with R, and spatial representation of Bioenergy resource with QGIS.

Keywords: QGIS; R; EPANET; learning by problems.

1. Introduction

During the last two years, students at Gipuzkoa-Eibar Faculty of Engineering in the Grade of Engineering for Renewable Energies (4 years) have many specialization subjects (<http://www.ehu.eus/es/web/eibar>). We will expose “Bioenergy” (second year), “Wind Energy” (third year), “Hydraulic Energy” (third year, in collaboration with the Faculty of Engineering of Bilbao) and “Ocean Energy” (fourth year), because of their interest in terms of the use of open software for the analysis of renewable energy resource and its geographical and spatial distribution. We must underline that the surveys of the students about the four subjects are generally outstanding.

- *Bioenergy*: teachers use learning by problems and learning by projects techniques during all the year (the evaluation is fully based on cooperative works on these projects). The software for geographical information systems QGIS is a powerful instrument for the analysis of biomass resource in specific regions taking into account even relevant variables for the extraction of wood.
- *Wind Energy*: 30% of the subject is taught by learning by problems techniques in which the software R for statistical computation is a basic tool. It not only allows statistical calculation of wind energy production for certain turbines at specific locations, it also allows the geographical representation of wind energy.
- *Hydraulic Energy*: 30% of this subject is also practical and based on learning by problems. Here the software EPANET is used in connection with R to study network of fluids, and management and maintenance of hydraulic systems. So the focus is practical with hand-on-exercises and all the teaching activities are closely interconnected with hydraulic systems and the maintenance of hydraulic energy plants.
- *Ocean Energy*: 50% of the subject is practical based on learning by problems with R. Seven problems of two weeks are designed to solve along the 15 weeks of the subject about the wave, thermal gradient and stream energy potential of the sea in chosen areas of the world. We use satellite and mesoscale model data for that, and all the process is developed by step-by-step spatial representations of energy potential and bathymetric characteristics of the sea via R.

This includes handling two groups of skills:

1. Solving real-life problems like the correct design of water supply tanks, overall planning for a given area and water, wind, wave or biomass availability estimation under several scenarios This involves the use of a high-level programming software like EPANET (<https://www.epa.gov/water-research/epanet>) and R (<https://www.cran.r-project.org/>). .

2. Spatial planning and geographical characterization of available energy resources. This implies the use of geographical information system (GIS) software and R, due to its modular nature holds the full functionality of any GIS software.

2. Method

When students select our subjects in their third and fourth year of studies they have a reasonable degree of computing programming skills and they are already somehow familiar with general purpose software like VisualBasic, Fortran or C++. Due to this initial background, it is possible for the team of teachers to design classes as a set of practical exercises within a bigger resource analysis project. The software we use in classes are EPANET, R and QGIS.

2.1. EPANET

EPANET is an open source code intended to model water distribution piping systems. EPANET is public domain software that may be freely copied and distributed. It is a Windows 95/98/NT/XP program, which can be installed without problems by the students in their own computers in order to work also at home. EPANET performs extended period simulation of the water movement and quality behaviour within pressurized pipe networks. EPANET's Windows user interface provides a visual network editor that simplifies the process of building piping network models and editing their properties and data. EPANET provides an integrated computer environment for editing input data. Various data reporting and visualization tools are used to assist in interpreting the results of a network analysis (<https://www.epa.gov/water-research/epanet>). It is worthwhile to mention that EPANET has made simple solving the type of non-linear equations involved. Before EPANET and similar tools this had to be solved using the Hardy-Cross method with successive approaches after a set of initial estimations of the unknowns.

2.2. R

R is freely available software that has turned out to be a perfect scientific tool due to its modular nature and its data processing capabilities. The reason for this is that R has a core module that can easily interact with an increasing number of packages, specifically developed by a growing amount of scientific communities that allow taking advantage of previous research. Due to the high potential of R, students feel that by incorporating R into their syllabus, they have gained access to a cutting edge, powerful and valuable tool that will make a difference in their professional career.

Additionally, R, apart from being free software, is continuously being developed with never ending improvements in the form of new packages that are adopted by an increasing

number of scientific communities. After students have learned how to use it, they will become members of this huge community. Additionally, all the information on maps representation, bathymetry, wind data, wind rose representation, water management and associated spatial planning, is usually freely available and made public by regional, national and European institutions using Geographical Information Systems (GIS) standards, usually *.shp* files. For this reason, students need to effectively read this information, calculate results and finally, yield a spatial representation of the same. Packages like “sp” “rgeos”, “rgdal”, “maps”, “maptools” and “mapdata” have been developed to make R work with full functionalities just like any GIS software, while exhibiting all the capabilities of any high-level programming software.

2.3 QGIS

QGIS is an official project of the Open Source Geospatial Foundation (OSGeo). QGIS provides a continuously growing number of capabilities provided by core functions and plugins. You can visualize, manage, edit, analyse data, and compose printable maps. Get a first impression with a more detailed feature list. This specific software for geographic information systems (GIS) purposes offers a more visual interface than R for geographical representation and spatial analysis. It can be a good complement of R to obtain a more understandable design in the presentation of maps, and to facilitate more visual operations than rough codes and scripts needed in R.

2.4 Learning by problems

Using EPANET, R and QGIS to introduce concepts related to the subjects mentioned above, represents for our students a real and pragmatic way of problem solving. Taking into account Bloom's (1956) Taxonomy of Educational Objectives for Skills-Based Goals, they get a high level of expertise on ‘guided response’ and ‘mechanism’: 1) the student knows the steps required to complete the task, and 2) performs the tasks in a confident, proficient and habitual manner. The student simulates what the scientist do every day and use the logic of discovery instead of the logic of justification (Hanson, 1958). As Clement states (Clement 1988, 2008) in his deep study on scientific creativity, when dealing with a problem heuristically there is no difference between the problem solving capacity of an expert and of a student. That is, the students should know the real scientific practice, and not only the final important and supposedly finished theories (Chi et al., 1981, 1989). The state of the art in this domain has been developed very deeply in constructive problem solving via the use of analogy, visual thinking, spatial abstraction and other different heuristic instruments have been pointed out for that (Welsh 2012, Simons 1993, Newel 1972). We will show that the mentioned software is a powerful instrument to implement this heuristics understood as the art for solving problems.

3. Results: examples

3.1 EPANET-R for hydraulic resource analysis

For example, students learn to read relevant information of water facilities from public institutions websites and at a second stage, they learn how to extract relevant information and put it on a map to represent, for example, river's catchment or flooding areas (Fig.1-2).

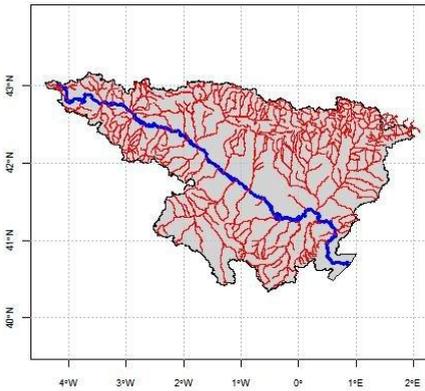


Fig. 1. Layout of Ebro river's catchment

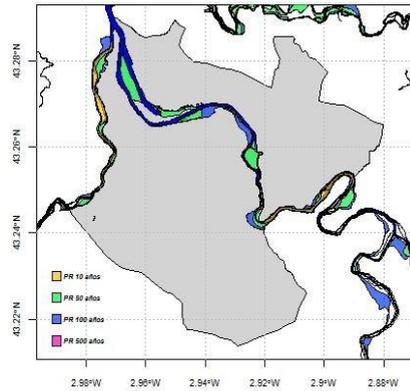


Fig. 2. Flooding areas in Bilbao city

The skills they get include the estimation of water availability in the frame of climate change scenarios as provided by the last AR5 report and associated CMP5 models projections. Students learn how to download CMIP5 data from: <http://climexp.knmi.nl/selectdailyseries.cgi?someone@somewhere>. Furthermore, visual thinking is trained heuristically by the interpretation of the relation between altitude isolines and the catchment of the valley around the river along the gradient.

3.2 R for wind and wave energy resource assessment

Here students represent spatially the wind energy potential in terms of Capacity Factor of the offshore floating wind farm over the Iberian Mediterranean area. Or they represent the wave energy potential over the Bay of Biscay (kW/m) based on the TOPEX satellite data (see fig. 3) .

The skills they get include the estimation of energy resource and its spatial distribution, and the treatment of rough data coming from mesoscale models and satellites. Students learn

how to download data of TOPEX from the NOAA (National Oceanic and Atmospheric Administration):

https://www.nodc.noaa.gov/woce/woce_v3/wocedata_2/sat_sl/topex/docs/topex_doc.htm

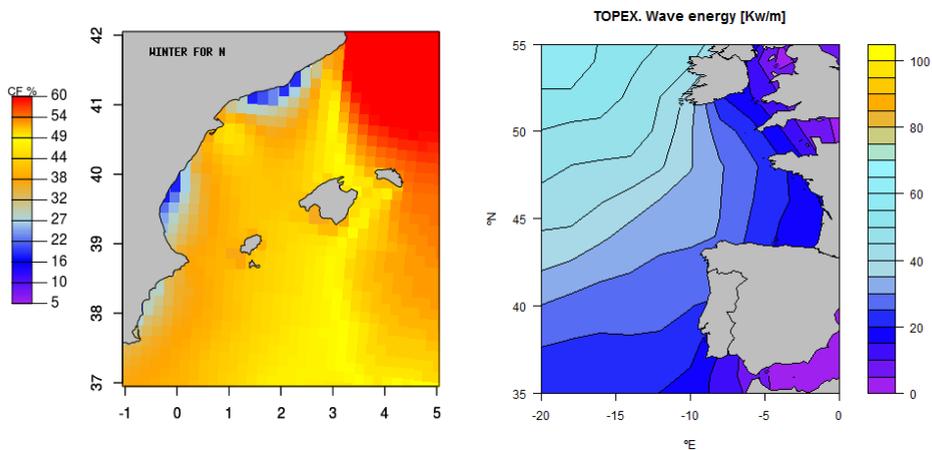


Fig. 3. Wind energy (Balearic Islands) and Wave Energy (Gulf of Biscay)

The heuristic of this kind of maps is important because implicitly these colour representations are huge numeric matrices constructed by several operational variables in the R algorithm developed during many class hours.

3.3 QGIS for bioenergy resource

In this case, the learning by problems project intends to quantify, locate and revalue the available forestry biomass as well as the forestry and wood waste for its subsequent thermal energy production. As expected, as they belong to two different types of biomass (forestry and industry residues), it would not be logical to apply a unified calculation methodology. Before knowing for sure the thermal energy that could be obtained from woody origin biomass, a free software program called QGIS will be used to find out the wooded area of the region (Figure 4). The restrictions of protected areas and nearness of roads are taken into account, together with the location of forest species, in order to calculate different biomass resource options over their intersections.

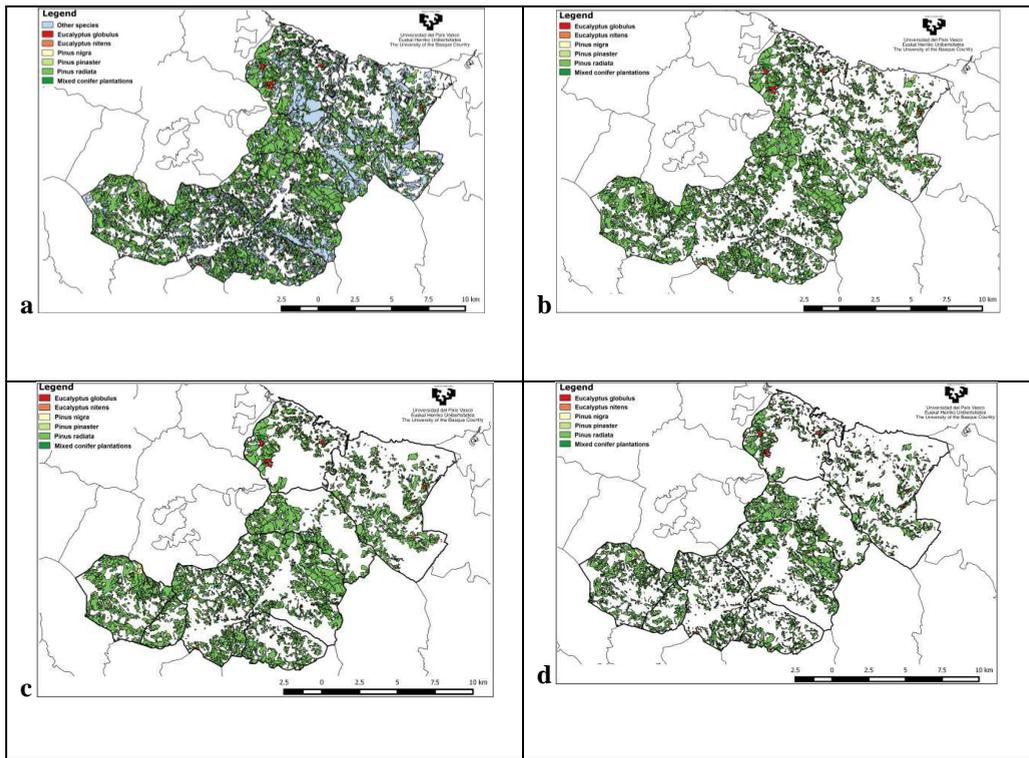


Fig. 4: QGIS generated maps: a) Location of all forest species in Debabarrena b) Spatial distribution of total bioenergy potential in Debabarrena c) Location of bioenergy without protected areas d) Location of bioenergy near roads and without protected areas

Heuristically speaking, the logical construction of the inner algorithm in order to superpose several geographical layers with different levels of priority in the forest establishes a creative hands-on activity for the visual representation, which is specified locally in each region and type of forest.

4. Results in the classroom and conclusions

We are applying these learning by problems techniques via free software in the Grade of Engineering for Renewable Energies for the last years -four years in some subjects. Taking into account that there are approximately 70 students per course we are speaking about more than 200 students, which have shown very good opinions in their surveys when they have been questioned about these subjects and the teaching methods used. For example, last year the teachers of Wind Energy and Ocean Energy obtained 4.5 out of 5.

The introduction of the mentioned software has enhanced our learning by problems perspective with respect to previous more theoretical and expositive way of teaching. We must also mention that this learning by problem techniques are being combined with more

general learning by project activities especially in the subject of Bioenergy, in which the cooperative work between students is remarkable. Furthermore, in case of Hydraulic Energy one of the teachers (Raul Garcia) works in a near hydrographic confederation (Cantabria) and consequently teaches very practical problems related to real jobs. Hence, a suitable learning atmosphere is created in the two schools due to this cooperative background together with the use of free software for the study of renewable energies and hydrology that constitutes areas with great social implications and job opportunities.

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Driving institutional change: challenge based learning for the University of the 21st Century

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Abstract

The main challenge faced by higher education is overcoming the gap between university education and the demands of society and the professional world. This gap cannot be accounted for merely in terms of a shortcoming in the relationship between the competencies of academic programmes and the real training needs of lifelong learners, but also involves the mismatch between the design of training models and students' expectations. The UOC has launched the PLA-Niu project in response to this problem. It aims to transform the subjects in the University's programmes into activities designed strictly based on competencies which are aimed at resolving challenges inspired by the professional sphere; to implement a new means of selecting, designing and managing learning resources based on content curation for learning, organising it into specific aggregators for each activity; and to provide a system that enables the production and organisation of training in an agile, flexible and personalisable manner. In this paper, we set out the experience of applying the PLA-Niu in the University as a whole, and present its characteristics, explain the strategies and measures involved in its implementation, and share the reflections of those involved from a critical perspective.

Keywords: *challenge based education; situated learning; competency based design; new learning models; innovation management; lifelong learning.*

1. Introduction

Years after the turn of the twenty-first century, it seems that higher education and the professional world are still living in separate universes. There is a persistent gap between the training offered by academic programmes and the training needs of lifelong learners. According to a study commissioned by the Universitat Oberta de Catalunya (Open University of Catalonia, UOC) on digital learners and the impact of socio-technological and sociocultural trends on education, there is a gap in competencies between graduates from regulated systems and the demands of the labour market and professional environments. This is especially true in terms of technological, creative and business skills (Moyano, Bouchet, Paniagua, & Mas, 2016). There is also a need for training models that offer shorter and more specific courses which enable training to be better adapted to the competencies required at any given time, instead of investing time and effort in long-term bachelor's and master's degrees with general approaches (Moyano et al., 2016; Guàrdia, Witthaus, Padilla, & Girona, 2016). Moreover, the various experts consulted for the study all warn of the stress on current education systems and support the idea of creating new more flexible forms of training based on competencies, in order to provide a better response to the needs of learners and the professional world (Mas, 2016). Meanwhile, universities are finding it difficult to evolve in terms of their learning methodologies. In this respect, Bartolomé & Grané (2013) when discussing universities, say that many of the ideas still predominant in education, such as standardised training and the authority of the teacher, are in contrast with the transformation of significant aspects of the knowledge society, such as copyright, digital identity and information management.

Apart from being an online university, the UOC is an institution that works within this environment. As a general university, it offers official qualifications within the regulated university system to 54,000 students in many different knowledge areas¹ within the framework of the EHEA, and as such the UOC is affected by the same problems as most similar institutions.

This is therefore the context of which the PLA-Niu project is a part, and it is designed to be a methodological change in the conception of the subjects to be implemented in the entire range of training at the UOC. As we will see below, the characteristics of this new design for training contain the DNA of a whole range of changes which are designed to bring the experience of studying at the UOC closer to the new educational demands of the twenty-first century.

¹More than 100 master's degrees, 3 doctoral programmes and almost 300 diplomas and specialist courses in various knowledge areas, ranging from computer engineering to business sciences and health sciences. See <http://www.uoc.edu/portal/en/universitat/coneix/index.html>.

2. The starting point

Based on the context described above, the key factors in the initial situation are the major challenges faced by both on-line and classroom-based higher education institutions:

1. The need to train students so that they can cope with the changing nature of the workplace, and develop the competencies that may be associated with it.
2. Provide students with tools to ensure academic success and encourage their continuance in university training programmes.
3. Assist students in their educational planning and time management.
4. Provide teaching staff with the support necessary to keep them constantly updated and involved in the design, monitoring and assessment of the learning process, and promote its innovative and creative character.
5. Highlight and examine in depth the design of training based on the activity and provide contextualised training based on or inspired by real experiences.
6. Ensure a methodological quality standard in subject design.
7. Diversify the range of educational content and resources, to respond to different types of intelligences and relate more closely to the different generations of students that make up today's digital society.

To drive this change and transform this situation, the university has made a methodological commitment involving the implementation of the PLA-Niu project², which covers all the programmes offered by the UOC. This project has been led by the eLearn Center – the centre for research and innovation in digital education at the UOC – with Oberta Publishing, the University's content and educational resources production department, and has been promoted by the Office of the Vice President for Teaching and Learning, as we shall see below.

3. Description of the methodology implemented

The PLA-Niu aims to create a methodological change in the subject design of all the programmes offered by the UOC. According to this methodology, each subject is considered in terms of a sequence consisting of what are known as PLA activities (Figure 1). They aim to ensure that competence-based design genuinely impacts on students' training; to contextualise this training activity in challenges and situations related to the professional sphere or to the students' daily lives by applying the principles of situated learning (Guàrdia, Sangrà, & Ahumada, 2006; Oregon Technology in Education Council, 2007; Stein, 1998; Lave & Wenger, 1991); and to implement a methodology and a system

² PLA-Niu is explained in section 3. Description of the methodology implemented.

for managing learning resources based on content curation for learning, which links them closely to the learning process.

Strictly speaking, a PLA activity is a compact form of training activity, which is defined based on a situation related to a challenge, is competence-based and designed around the activity to be carried out by the student. The acronym PLA stands for ‘Performance Learning Activity’ (Table 1).

Table 1. Definition of Performance Learning Activity.

P (PERFORMANCE)	L (LEARNING)	A (ACTIVITY)
The student is guided by a professional or training situation in order to obtain a result related to a challenge.	The aim is to master the skills, knowledge, attitudes and values that arise from the competencies in the programme.	The learning process is guided by a continuous assessment activity.

A PLA activity contains the following items: a challenge, competencies, a continuous assessment activity and the Niu (Figure 1).

As shown below, these items are closely interlinked, with the PLA activity acting as a matrix that ensures the educational consistency of all the components in the learning process:

- **Challenge.** This contextualises the training activity with a situation related to the professional sphere or with an application in everyday life using an approach focused on overcoming a challenge. This challenge is related to the skills and learning outcomes that lead to the PLA.
- **Competencies** of the programme that are worked on specifically in the PLA activity, specified in the learning results that are to be obtained. These provide the inspiration for the challenge and guide the design of the activity and its deliverables.
- **Continuous Assessment Activity (CAA).** This is the learning activity that the student must carry out in order to develop the competencies of the PLA which are contextualised with the challenge. By completing the activity, the student prepares deliverables that act as evidence to assess the PLA. Estimating the minimum time for training that students need is particularly important in the design.
- **Niu.** The training resources and content required to carry out the CAA successfully. These resources may be produced internally and externally. They are accessible within the PLA by means of a visual aggregator, after a content curation for learning work presents them, highlights their value and contextualises them for use in the training activity.

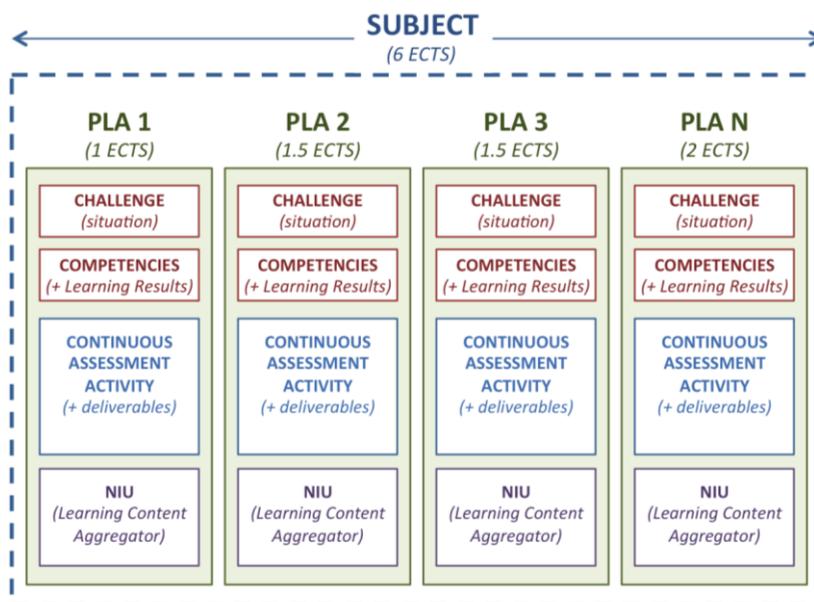


Figure 1. Structure of a subject based on PLA activities (the number of credits may vary).

4. Experience of implementation

4.1. Strategy

The implementation of the PLA-Niu project is based on four guiding elements, which ensure the quality of the process: (a) a top-down implementation methodology according to the University's strategy; (b) a framework of reference based on studies of trends in higher education; (c) incremental intervention; and (d) personalisation.

- (a) At the University, **the project is being driven by the Office of the Vice President for Teaching and Learning**, and it is led by the eLearn Center and supported by the Library and Technology areas, with information and communication initiatives for all those involved, and cooperation and teamwork encouraged.
- (b) Various **studies of trends in higher education** led by the eLearn Center³ are used to provide a framework of reference for the PLA-Niu project.

³ *Future Scenarios for Digital Learners* (Moyano et al., 2016) and *Next Generation Pedagogy: IDEAS for Online and Blended Higher Education* (Guàrdia et al. 2016).

- (c) We decided on a strategy of **incremental intervention**, which emphasises the factors that have defined the educational model of the UOC for over 20 years, making them evolve to meet the challenges that will affect education in the coming decades.
- (d) The advisory process consists of **personalised and intensive support** for the teachers' work on creating their subjects.

4.2. Support for teaching staff in subject design

Each teacher involved in the PLA-Niu designs their own subjects, accompanied by expert advisers from the eLearn Center during three individual working sessions. The goal at the end of these sessions is to establish the basic structure of each PLA, defining and identifying the main elements: identifying the challenge, a proposal for an activity, measurement of the working time involved in training, and the list of contents and resources that form part of the Niu. The medium containing all this information is a template that we call the Teaching Pre-Project. This document has two basic functions. First, it is where the preliminary design of the subject takes place, and second, it begins the process of requesting, producing and managing the rights to the resources, including their economic management.

4.3. The PLA-Niu project in figures

In the long term, the project affects the entire range of training at the UOC. To achieve this objective, its implementation is planned in several phases lasting two months each. Currently, the first phase has been carried out, with the data shown in Table 2. Priority was given to the new subjects and programmes, of which a total of 115 are anticipated for the first semester of the 2017–2018 academic year. In this phase we worked with 45% of these.

Table 2. Institutional scope of the PLA-Niu project.

	Faculties	Programmes	Subjects	Teaching staff⁴	Advice sessions
Phase 1 (Nov.- Dec. 2016)	5	12	13 bachelor's degrees 38 master's degrees	37	150
UOC Total	7	24 bachelor's degrees 78 master's degrees 249 postgraduate diplomas, specialisations and courses		262	

⁴The UOC has 262 faculty members responsible for subject design and 2,991 teachers involved in classroom teaching.

5. Conclusions

After the first phase had been completed, the project was evaluated, which enabled us to identify areas for improvement and items to be reinforced, and these measures will be implemented in later stages. The experience also enabled adjustments to be made during the process. The evaluations and reflections made led to the following conclusions:

- Personalised advice has an effect on teacher training because it enables teachers to cope autonomously with the design of future subjects. This is expected to have a positive impact on the empowerment of teachers in terms of the PLA-Niu.
- The project requires increased collaboration between the various parties involved, and creates new working synergies that incrementally foster opportunities for change in the institution as a whole.
- In order to roll out the change to the institution as a whole, the support and advice teams must be expanded and the management processes and tools they use must be optimised.
- The PLA-Niu leads to changes in the processes of creation and management of subjects, from their design to their implementation in the classroom. This changes how teachers' work is organised, which led to some resistance.
- Managing change is a difficult process which involves adapting to new ways of working, thinking about subjects and like all changes, creates resistance; however, a process with clear planning, with a permanent support team that actively listens to specific needs, and confidence in the project, shows that it is possible to implement it within the stipulated deadlines.
- The process leads to the achievement of a common standard of quality in all subjects. At the same time, it has mechanisms to ensure the PLA-Niu adapts to the specific characteristics of each subject and the application of new training methodologies.
- Fragmentation into PLA activities lays the foundations for the future implementation of a range of training that is more flexible and dynamically adaptable to the demands of learners, to the pace of development of society and to the professional world.
- The PLA-Niu project suggests a need to create new training scenarios and environments, as well as to redefine the roles of teachers, incorporating new figures into the institution. An example of this would be content curation for learning.

From this point, and based on our experience, in addition to continuing with the next phases of work, there is a clear need to observe and analyse the result of the implementation of the PLA-Niu subjects in the classroom, in terms of both their workings from the point of view of teaching and their acceptance by students.

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Using COCA to Foster Students' Use of English Collocations in Academic Writing

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Abstract

Using Corpora in foreign language teaching is one of the very efficient ways in proposing solutions for pedagogical issues, either through adopting a corpus-based teaching approach or through using the corpus in developing material. Developing academic writing competence is a challenging pedagogical issue for English teachers as well as learners. Second language learners come across considerable challenges as they are developing their academic writing competence. One of these challenges is the use of English collocations since that learning about collocations is of a crucial importance. Hence, due to the wide variety of collocations and their different types, one of the challenges that face both L2 learners of English as well as teachers is how to use English collocations successfully in academic writing due to the fact that collocational awareness and proficiency is a necessity for competent written discourse especially in academic writing. Therefore, academic writing proficiency is one of the major problematic areas that university students encounter. This paper focuses on how to direct students to a more effective use of Corpus of Contemporary American English (COCA) in order to foster their learning process of different English collocations, and use English collocations accurately in their academic writings. This paper illustrates search mechanisms and search strings that could be implemented effectively on COCA to get more representative and accurate collocation results.

Keywords: *corpus, academic writing, collocations, COCA*

1. Introduction: Online Corpora & COCA

The existence of online corpora in the field of applied linguistics significantly changed all the perceptions and approaches of most researchers in the modern age. Using online corpora in teaching and developing material is no longer a luxury as people have thought; it became a necessity and an efficient way to take second language pedagogy into the new digital era. Mark Davis' 520-million-word Corpus of Contemporary American English (COCA) is the richest freely searchable online corpus for its wide range of texts that are from different genres. It can be efficiently used to propose solutions for many pedagogical challenges that face language teachers and learners with respect to English collocations. As far as academic writing is concerned, English learners find difficulties when using collocations. There are two common mistakes university students tend to make in academic writing: incorrect or inaccurate use of collocations or using a collocation that is too informal to be used in an academic writing. In this paper, the researcher will introduce different search mechanisms and search strings that enhanced university students' ability to analyze their collocation errors and find accurate collocates in the academic sub corpus of COCA.

2. Literature Review

Teaching academic writing has been a major concern of academic research recently. Some studies suggested new frameworks and techniques for teaching academic writing, and some other studies directed the attention to the use of corpora in teaching writing in general, and academic writing in particular. Some studies conducted experimental research to test the corpus-based teaching approach on a number of students and observe the impact of using the corpora on their language proficiency. Other studies used the corpus to develop material for teaching English and created word lists to help students improve their language competence. Alex Gilmore (2009) found that free online corpora helped students have more natural writing. He investigated whether training a number of intermediate Japanese university students to use the BNC and COBUILD online corpora will effectively enhance writing second drafts of their academic essays or not. He also explored their reactions and preferences after using these online corpora. In this study, the corpora were used basically to help students correct grammatical problems occurred in their first draft. The results showed that students produced more natural texts in the second draft, and the problematic areas highlighted in the first draft were mostly corrected. Gilmore concluded that the use of the corpora can have an effective role in enhancing writing skills. He also found that using the online corpora does appeal more to visual students who are more analytic and logical. However, L2 learners should receive an appropriate and sufficient training in order to be able to use the corpora effectively.

Applying the use of corpus-based teaching approach on an experimental group and investigating the impact on students' performance is a significant turning point in the literature of corpus linguistics. Jafarpour et al (2013) compared the effect of a corpus-based teaching of collocations applied on an experimental group to that of traditional approach applied on a control group. The researchers focused on teaching collocations of near-synonymous pairs. They concluded that the corpus-based approach in teaching collocations outperform the traditional ways. The researchers used concordance materials retrieved from the BNC corpus, and collocations have been taught in context. Jafarpour et al found that their corpus-based teaching approach had a significant effect on the students' knowledge and competence of collocations in the experimental group. According to Jafarpour et al (2013), student in both groups achieved a considerable progress; however, students in the experimental group showed a significant improvement in their writing proficiency after using the corpus producing more authentic language.

Likewise, Yoon (2008) investigated the progress in students' writing performance with corpus use, and how their writing competence has been influenced. Yoon investigated six case studies of L2 students in an English for Academic Purposes course. The results showed that the use of the corpus had a significant and instant impact on the students' writing competence and helped them find immediate solutions for language problems they might have encountered. The participants' writing process went through some minor changes after using the corpus, yet they are effective. In addition, this corpus-based approach developed the students' perceptions of lexicogrammar and language awareness. Another significant finding in Yoon's study was that the students became more autonomous learners taking more responsibility of their learning process and correcting their own mistakes due to their corpus experience.

Focusing on English for academic purposes (EAP), Lee and Swales (2006) conducted their qualitative research testing the use of corpora in a customized EAP course for doctoral students using a special corpus for academic writing and speaking. Students in this study compared their own academic writing to those of more experienced academic writers, and they provided reports discussing their findings of these comparisons and how the use of the corpus can influence their academic writing in the future. As the authors stated, this approach can be specifically of benefit for academic students who are writing their theses and need to develop their styles and academic competence through looking up an academic specialized corpus of their field (Lee & Swales, 2006). The participants' feedback was very positive that they found that using the corpus is 'confidence-building and empowering', and they also found the corpora much more useful and effective than reference and grammar books. The study proved to be very efficient that most of the participants bought their own versions of Wordsmith concordancing software to use it after the course.

In a more field-oriented study, Walker (2011) used the Bank of English corpus (BoE) and the British National Commercial Corpus (BNCc) for teaching business English. Walker stated that business English teachers encounter many questions that require answers and conducting some research. Walker suggested that such questions can be answered through investigating the 'collocational behavior' of specific key lexis; this can reveal all the different senses of a word and the other words that co-occur with it in a specific context. Applying a corpus-based teaching approach in two case studies, Walker reaches a conclusion that most collocations are not merely random combinations of words; it is the significantly frequent collocates that show the different meanings and uses of a word. In addition, using corpus here helps to reveal whether there are any negative connotations associated with the collocation (Walker, 2011). Hence, combining collocation lists would play an invaluable role in improving learners' language competence.

Very specifically, Daskalovska (2015) investigated the activities based on corpus for learning verb-adverb collocations in a comparison to the course book regular activities. The results of the study show that the students who used the online concordancer performed much better in the test they took. The findings of this study highlighted how motivating and engaging the corpus-based activities were to the students. The researcher concluded here that the online corpus is a very dynamic and influential tool that has its positive impact on the L2 learners.

Literature illustrates how influential is using online corpora in teaching English as a second language. However, this paper takes a different and more practical approach regarding corpus-based teaching which is exploring different mechanisms and search strings that could effectively retrieve more accurate results when looking up a collocate in an academic context.

3. Collocates Search on COCA

COCA search options give users multiple chances to check different types of collocations. The most common collocations that are usually looked up: verb-noun collocations, adjective-noun collocations, adverb-verb collocations, verb-preposition collocations, and adverb-adjective collocations. The current paper discusses a number of search mechanisms that are used on COCA and yielded positive results. The search mechanisms proposed in the current paper have been examined in two different academic language classes. They have been first examined for error analysis in translation classes, and second in an academic essay writing class. There are different sub corpora within the COCA; the one that I focus on in the present paper is the academic sub corpus. The suggested search strings in the present paper raised my translation students' awareness of their errors and helped them correct these errors and find accurate collocations when they translate academic texts from

Arabic into English. Likewise, using the proposed search strings fostered the students' writing performance in my academic writing class.

There are two ways of conducting collocate searches on COCA: either to use the default list option or to use the collocates option to limit the results. Table 1 illustrates possible search strings that can be conducted to check different types of collocations using the *collocates* option and the (POS) list which is available in the search engine on the corpus to specify the part of speech that will to be looked up. Academic sub corpus must be checked first in order to get specific results from the academic corpus.

Table 1. Proposed search strings using the list display option

Collocation	Search String	Examples
verb-noun	[verb].[nn] ex. decline _nn*	(decline) with <i>age/(decline) over time/(decline) the offer</i> (conduct) <i>research/ investigations/ interviews</i>
adjective-noun	[adjective].[nn] ex. _j* results	<i>current/preliminary/ significant</i> (results) <i>important/ profound/ long-term</i> (implications)
adverb-verb	[adverb].[v] ex. _r* update	<i>regularly/ constantly/ peri-odically</i> (update) <i>critically/ carefully/ properly</i> (evaluate)
adverb-adjective	[adverb].[j] ex. _r* significant	<i>statistically/particularly/potentially</i> (significant) <i>perfectly/ barely/minimally</i> (adequate)
verb-preposition	[verb].[prep] ex. rise _i*	(rise) <i>to/in/from</i> (express) <i>in/about/to</i>

The search mechanisms and search strings proposed in the current paper have been practiced with my translation students as well as the academic essay writing students. Applying the suggested search strings on COCA enhanced translation students' performance in their translations from Arabic into English. They started to use accurate collocates in their translations of academic texts. Similarly, the academic essay writing students started to use accurate collocates which are also more academic-related. The errors of using English collocates have been significantly declined in both groups after implementing the suggested search mechanisms on COCA.

Another mechanism could be implemented to look up collocations using the collocates display option available on the corpus. Using this option, there is a tab for the target word which the student/learner needs to look up its collocates. The part of speech of the target word should be specified using the (POS) list. Likewise, the part of speech of the collocates that would be looked up should be specified using the (POS) list as it is displayed in Figure 1. The valuable option here is that the student/learner could limit the search to either the collocates occurring before the word or the words occurring after, or both. In Figure 1, I specified the search to the two words occurring after the target word.

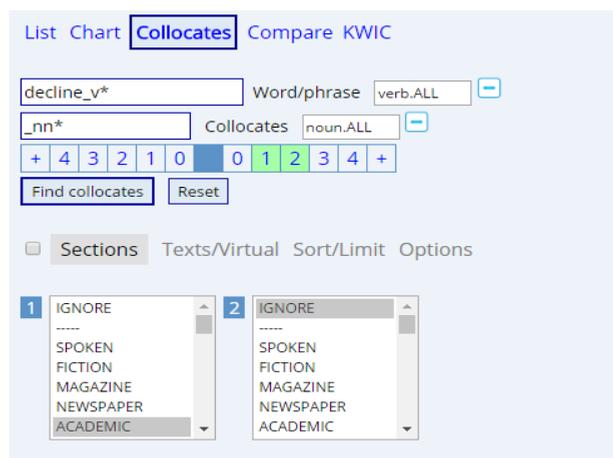


Figure 1. looking up collocations on COCA using the collocates display option

There is another option that many students find valuable when looking up collocates. Many students find difficulty figuring out whether a word/phrase could be used academically or not. Using square brackets and the equal sign (=), learners could get synonyms for the word they need with a specific collocate and limit the search to the academic sub corpus. Figure 2 displays the search for synonyms for the word *awesome*, which should not be used in an academic writing, and the target synonyms should collocate with the word *result*. The

academic sub corpus is selected to limit the results. Figure 3 displays the results of the search showing synonymous words for awesome which can collocate with results.

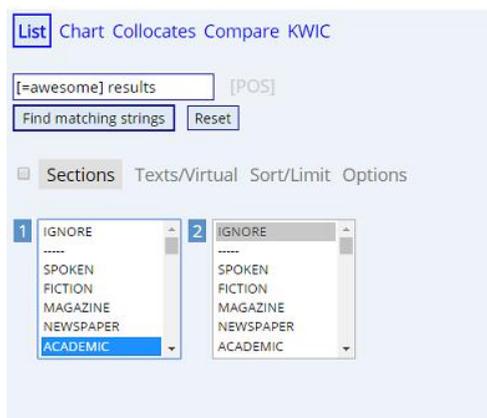


Figure 2. Using the equal sign (=) to look up synonyms and their collocates

		CONTEXT	FREQ
1	<input type="checkbox"/>	REMARKABLE RESULTS	48
2	<input type="checkbox"/>	AMAZING RESULTS	38
3	<input type="checkbox"/>	TREMENDOUS RESULTS	10
4	<input type="checkbox"/>	ASTOUNDING RESULTS	5
5	<input type="checkbox"/>	SPLENDID RESULTS	2
6	<input type="checkbox"/>	OVERWHELMING RESULTS	1
7	<input type="checkbox"/>	BREATH TAKING RESULTS	1
8	<input type="checkbox"/>	AWESOME RESULTS	1
		TOTAL	106

Figure 3. The results of using the search string [=awesome] results

4. Conclusion

The use of online corpora as a tool in teaching languages is unlimited; new applications and practices come up every day to serve language pedagogy. COCA is one the richest online resources that could be efficiently used to propose solutions for many pedagogical challenges that face English language teachers and learners regarding the use of collocations. This papers focused on practical use of search mechanisms and search strings with translation students and academic essay writing students. Both groups have shown significant development of using collocations when they translate academic texts from Arabic into English, or when they write an academic essay.

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Teacher training: a model for introducing innovative digital methodologies for learning Mathematics

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Abstract

This paper shows a model of teacher training developed by the Department of Mathematics of the University of Turin, aimed at introducing teachers to the use of innovative methodologies for learning Mathematics and for developing disciplinary and cross-cutting competences. The learning methodologies proposed are mainly based on Problem Posing and Problem Solving, the use of an Advanced Computing Environment, of a Virtual Learning Environment and of an Automated Assessment System. The training model, designed in blended modality, mainly relies on the creation of an online community of practice, where teachers, supported by tutors, collaborate in the creation of interactive learning materials for their classes. They acquire competences not only in the use of learning technologies, but also on sharing and collaborating in virtual environments; they learn how to develop self-tailored didactic methodologies. The key strengths of this model are highlighted and the results, achieved after the experimentation in several projects, are discussed, showing the effectiveness of the model.

Keywords: *Advanced Computing Environment; Automatic Assessment System; Mathematics; Problem Posing and Solving; Teacher training; Virtual Learning Environment.*

1. Introduction

Mathematics education is at the core of recent international discussions (PISA, 2003), which have been followed by the definition of new European aims and directions (Council of European Union, 2009) (Official Journal of the European Union, 2006), in turn followed by national guidelines and reforms (MIUR, 2010) (MIUR, 2015). They all clearly express the necessity to address teaching towards a competence-based approach to develop problem solving competences, supported by the use of technologies. Since every reform on teaching cannot actually be realized without a spread and rooted awareness that changes are needed, governments had to make a great effort in teacher training. Many teachers feel the necessity to innovate their methods to meet the interests and expectations of the students of the third millennium (Prensky, 2001), as they realize that old-fashioned methodologies do not work anymore. As students are required to develop disciplinary and cross-cutting competences, so teachers need to develop methodological competencies to design instructional strategies to enhance learning. They need a skilled support to undertake such changes.

In 2012 the University of Turin has been called by the Italian Ministry of Education to support a strong action aimed at innovating Mathematics teaching and learning in the secondary schools (Brancaccio, et al., 2015a). The methodologies proposed, rooted in problem posing and solving, make use of an Advance Computing Environment, a Virtual Learning Environment and an Automatic Assessment System for learning Mathematics. Through this and further experiences, the Department of Mathematics of the University of Turin has developed and experimented a model for teacher training aimed at providing teachers with support, instruments and methodologies for developing - autonomously and collaboratively - instructional practices intended to empower Mathematics learning. This paper shows the methodologies proposed and focuses on the teacher training model developed, presenting and discussing some experiences where it has been applied and the results obtained.

2. State of the art

Literature overflows with analysis of teacher training strategies (Avalos, 2011). Different techniques have been proved to be successful to improve teaching skills and students' results: coaching, metacognitive reflection, team working, co-working and many others. Remarkable results have been obtained with the participation to communities of practice (Vescio, et al., 2008), especially when they are focused on the discussion more than on instructional techniques (Supovitz, 2002). The web facilitates the creation and the activity of a community of practice (Ellerani, 2010), especially when participants come from different places. Although, just as different teaching strategies achieve different results depending on the type of students and classes, also training courses should be adjusted

according to teachers' characteristics and needs (Darling-Hammond & Bransford, 2007). The model of teacher training shown in this paper is deeply based on an online community of practice, where cooperative learning, course-crossing, synchronous and asynchronous tutoring are fostered.

3. Innovative digital methodologies for learning Mathematics

The methodologies proposed for enhancing Mathematics education are the following:

- **Problem Posing & Solving (PP&S):** it promotes the cognitive processes underlying the assessment of students. The main features of the PP&S consist in the attention that is given to the chosen problematic situations (posing) and the modality in which new technologies are used to find solutions (solving). The student, freed from the burdens of calculations, focuses on solution strategies. The problem posing and problem solving skills developed are also very useful in all disciplines as well as for the formation of a more informed citizen (Brancaccio, et al., 2015a).
- **Use of a Virtual Learning Environment (VLE):** it opens up a great variety of interaction channels among mentors and learners of different level. The web pages can be realized in different styles, shapes and formats according to the teaching method adopted. VLE structure and tools promote collaboration and sharing ideas and allow the birth of communities of practice. (Lave, 1991).
- **Use of an Advanced Computing Environment (ACE):** while maintaining the ease and immediacy of use of a common word processor, an ACE enables its users to improve the ability of representing scientific objects. Students' reasoning benefits from numeric computations, symbolic calculus, geometric visualizations in two and three dimensions, and embedding of interactive components where the change of parameters allows to analyze different results (Palumbo & Zich, 2012).
- **Use of an Automated Assessment System (AAS):** it has evident advantages for teachers, who have the chance to optimize the development of formative assignments while reducing time-consumption for corrections, and for students, who can practice at their own pace obtaining immediate feedback and results to acknowledge their level of preparation. Both questions and assignments created through the AAS proposed are algorithmically based: students can obtain different data or graphics at every new attempt, guided resolutions, feedback and questions can be automatically proposed on the base of previous answers (Barana & Marchisio, 2016).

In the projects for teacher training proposed by the Department of Mathematics, instances of the e-learning platform of the University of Turin, maintained by the ICT services from the Department of Computer Science, are used. The platform is integrated with the ACE

and the AAS, so that teachers and students can benefit from all these advanced tools in the same learning environment.

3. The model for teacher training

3.1. Aims of the model

The model is intended to provide secondary school teachers with competences on these innovative methodologies for learning Mathematics. In particular, teachers develop skills in problem posing and solving and in the use of a VLE, an ACE and an AAS for learning; they learn how to collaborate online and work in a community, so that they can lead their classes in the development of Mathematics competences.

3.2. Description of the model

The teacher training model includes the following features:

1. training modules in presence for a total duration of about 10 hours, organized in:
 - a. use of an ACE for interactive learning (3 hours),
 - b. use of an AAS for the formative and summative assessment (3 hours),
 - c. use of a VLE for building learning communities (2 hours),
 - d. Problem Posing and Problem Solving using an ACE (2 hours);
2. synchronous and asynchronous online training in a VLE, through:
 - a. forums of discussion for the asynchronous tutoring, monitored by tutors, which foster teachers' collaboration and exchange of materials and experiences,
 - b. weekly online synchronous tutoring held via a web conference tool integrated in the platform, which allows interactions between tutor and participants through the voice, a chat and the screen-sharing,
 - c. multimedial didactic materials,
 - d. databases for sharing didactic materials created and used by teachers;
3. implementation of an online community of practice, which learns and works collaboratively, focused on the enhancement of teaching and learning;
4. practice of course-crossing;
5. preparation of materials autonomously and collaboratively and testing on students;
6. evaluation of appreciation and usefulness of the training, for both teachers and students.

3.3. Implementation of the model

Although most of the training takes place online, initial meetings in presence are often recommended, as the face-to-face approach is closer to the teachers' customs. Trainers are university teachers and PhD students (the latter will become the tutors for the online course) who show the methodologies and help teachers develop their own strategies. The training starts with a change of roles: teachers are asked to be students and to solve a problem, to answer an online assignment or to use the platform from the student's point of view. These activities are useful for introducing teachers to a student-centered approach: after experiencing the students' difficulties, they are keener to understand how they feel after a failure. The training in presence involves activities and tasks for teachers, they immediately start working and creating didactic materials which can be used in their classes. Trainers propose guided examples carefully conceived to be useful for learning how to use the instruments and for creating materials according to the methodologies proposed.

The training continues online in the same VLE that teachers will use with their classes. Once again, they become students and they can avail themselves of the synchronous and asynchronous online resources arranged by the trainers: they get ideas for learning activities to create and experience the effectiveness of these interactive methodologies, so they can be motivated to adopt them in their teaching. Tutors have the fundamental role of connectors between the teachers and the university professors who have designed these methodologies: their young age (around 25) facilitates teachers to ask questions when in doubt – they are in some cases similar to their children and don't have the austerity of university teachers – so they are considered as a precious support. The training is entirely focused on the methodological use of these learning systems: the disciplinary content is left to the teachers' competence. In such a way, they feel valued and the risk of demotivation is reduced: the effort asked to innovate their teaching involves only the methodology and not the content. In the platform, a community of practice soon comes to life. Sharing (materials, activities, experiences, mistakes, problems, solutions) is fostered not only among teachers, but also between them and tutors. This provides trainers with feedback about teachers' needs and difficulties, precious to improve the training materials, activities and strategies. Collaborative learning can also inspire them to promote collaboration among their students (Barana, et al., 2015). On the platform, teachers' courses are set to allow the course-crossing: they can enroll to their colleagues' courses without interfering with the gradebook and the tracking of students' activities and with no possibility of editing the course. Feedback, criticism and new ideas thus emerge, promoting teachers' professional and methodological growth.

The entire training is monitored through questionnaires periodically distributed online in order to register both teachers and students' satisfaction, improvements and problems. At

the end of the training courses teachers receive a certification of achieved competences recognized for their career, which acts as an incentive to participate; anyway, when they start to apply the methodologies developed in their classes, the motivational lever to continue the training is replaced by students' appreciation and results.

4. Realized experiences, results and discussion

The model was developed at the Department of Mathematics in 2011, and then used to support the action of the Italian Ministry of Education within the Project Problem Posing and Solving (PP&S) (Brancaccio, et al., 2015a). Since 2012 about 2400 Italian teachers have been trained on these methodologies. After the training in presence, they have the chance to join the project and continue the training online. The national community of teachers of the PP&S is still working and is progressively growing: nowadays it counts 1200 teachers from 900 different schools. The initial training in presence received a large appreciation: from questionnaires distributed the overall appreciation reaches 4.1 points in a Likert scale from 1 to 5 (standard deviation: 0.8). 97% of the feedback is positive and 85% is good or very good. Regarding the online activities, in a survey distributed two years after the beginning of the project the online training was evaluated with 4.0 points on average (st. dev.: 1.0); about 85% of teachers actively participates to the community, visits other courses and uses the material produced by others. The speed in getting an answer to a request is rated with an average 4.2 (st. dev.: 0.8) and the professionalism of tutors with 4.4 (st. dev.: 0.8). The last result supports the assertion that the role of the tutors is strategic in an online community.

On the base of the great success of PP&S, other projects have been realized in local contexts. For their reduced dimension, they have been monitored more easily; for instance, the project "Lagrange e Cicerone al Computer" involved 35 teachers of high schools of Turin and registered a remarkable success. Results on the appreciation of the training are similar or even higher than those of PP&S; at the end of the project, teachers felt professionally enriched in a measure of 4.4 out of 5. In addition, the perception of usefulness of the methodologies proposed in relation with students' results visibly increased just after 8 months, as shown in Figure 1. That means that, in a short time, the training activities proposed made teachers able to change their instructional practices and to verify their effectiveness on students learning.

The flexibility of the model has been tested in projects with different targets, such as the training of university tutors aimed at helping reduce failure of students with difficulties in Mathematics. The training model needed some little adjustments to adapt to the context of remedial education and to university students, mainly involving the material proposed and the level of technical complexity of the use of the systems (Marchisio, et al., 2013). The

modular schedule allowed to propose a reduced training in the project Digital Mate Training (DMT) only focused on the use of an ACE for problem solving. The training has also been experimented in the Erasmus+ project aimed at discussing the methodologies proposed in the PP&S in a European scenery. Due to geographical reasons, the training has been conducted only in the online modality, with synchronous and asynchronous support (Brancaccio, et al., 2015b). The analysis of these different experimentations made it possible to detect some difficulties that are common among teachers. They all mainly related to the integration of technologies into didactic and to the time dedication that the training requires. The average age of Italian teachers is around 55, it is a challenge for them to change their practices and to learn how to use technological instruments; many of them are worried of not being good enough to manage similar activities in their classes. The key factors which allow them to overcome these difficulties, besides the help from the community, are their attitude and their openness to interactive learning. Learning must be a sharing practice, those who accept to learn from their students will get the highest results.

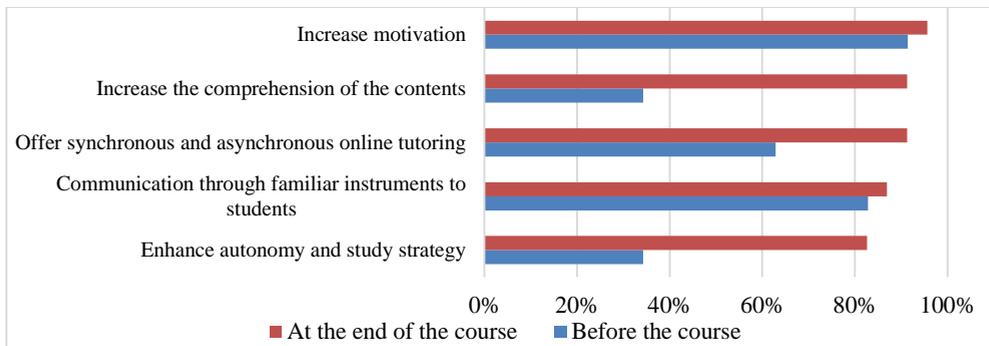


Figure 1. Teachers' perspective of effectiveness of the methodologies before and after the training.

6. Conclusions

In conclusion, the model for training teachers on the use of innovative digital methodologies for Mathematics, developed and experimented by the Department of Mathematics of the University of Turin, managed to give excellent results in terms of satisfaction and learning outcomes. Key strengths of this model are collaboration, sharing of practices and the presence of tutors. Creating and monitoring an online community of practice is a great endeavor for the University which dedicates time, money and employees in the maintenance of the platform and in the assistance to the training. However, good results show that it is worth the effort. In order to meet the teachers' need of certification of competences, some variations to the model are being experimented short cycles of synchronous tutoring replace the weekly ones; teachers must attend the web sessions and

produce learning materials to get the certification of the achievement of methodological competences. Moreover, the Department is interested in extending the model to other subjects. A first experimentation with Latin has already been realized with the collaboration of the department of Human Studies, with much satisfaction of all participants.

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Teaching Theory in Applied Degrees: A Critical Examination of Curricular Design for Translation Theory Subjects in Comparison with the Students' Expectations

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Abstract

Due to the practice-oriented nature of Translation and Interpreting study programmes, students are generally assumed to have a reluctant attitude towards the study of theory. However, previous empirical research allows us to dispel this myth: students are aware of the contribution of translation theory to their education as future translators. Taking into account students' needs and expectations, in this paper emphasis is placed on curricular design. A critical examination of the syllabi of Translation Theory subjects, focusing on learning outcomes and teaching methodology, reveals some (mis)matches between teaching planning and the students' expectations. The results obtained show a relatively high degree of coincidence between these two aspects on the one hand, while also highlighting some inaccuracies in the teaching planning of these subjects on the other. These two aspects should be considered a starting point for a revision of the curricular design in order to present an accurate description of the subject by means of an adequate explanation of the intended learning outcomes and teaching methodology, and in order to provide students with significant and useful insights into the theoretical dimension of translation.

Keywords: *Translation Study Programmes; Translation Theory Teaching; Curricular Design; Students' Expectations.*

1. Introduction

Degrees in Translation and Interpreting are usually very practice-oriented, as a result of a number of reasons among which the nature of translation (an applied activity) and the socio-cultural context in which the institutionalization of these studies took place (cf. Vega and Pulido, 2013: 45) can be cited. The applied, market-oriented character of translation study programmes is, at the same time, their main appeal; it is common for students to choose to embark themselves in translation and interpreting study programmes attracted by their innovative, up-to-date as far as the professional market is concerned, and applied approach, in comparison to more traditional philological degrees. Nevertheless, without leaving the inherent applied nature of translation aside, it is precisely the development of theoretical approaches which has allowed the practice of translation to be analysed in a systematic manner and has contributed to the consolidation of Translation Studies as an independent academic discipline. Therefore, it is only natural to expect that theoretical reflection (theoretical models, approaches, basic theoretical concepts of the discipline, metalanguage, etc.) is incorporated into translation and interpreting study programmes. However, a review of the study programmes offered at Spanish universities reveal that translation theory occupies a marginal role in the education of translator and interpreters to be (cf. Agost and Ordóñez-López, 2016).

The interconnection between translation theory and the actual activity of translation has still not been fully accepted in the professional, academic or training contexts. Within the Translation Studies literature, numerous scholars have outlined the benefits of more holistic and humanistic study programmes as well as the contribution that such training would make to the professional context and the discipline as a whole (Delisle, 1981; Gile, 1995, 2010; Mossop, 2003; Malmkjær, 2006; Agost, 2008). Besides, despite the wide-spread belief that students lack interest in theoretical subjects, the results obtained in previous empirical studies (cf. Ordóñez-López and Agost, 2014 and Agost and Ordóñez-López, 2015) allow us to dispel this myth. Translation and Interpreting students are not reluctant to theory, they are aware of the contribution of theoretical subjects to their training. In fact, they do not establish a clear-cut division between the theory and the practice of translation, which becomes especially apparent when dealing with methodological issues and with the acquisition of the discipline metalanguage.

Based on our previous research, in this paper emphasis is placed on curricular design, more specifically on examining to what extent students needs and expectations are being met regarding learning outcomes and teaching methodology. In what follows, a critical examination of the syllabi of Translation Theory subjects in comparison to the students' perceived needs is carried out. This examination will reveal the aspects in which (mis)matches can be found, which should be considered a starting point for a revision of the planning and curricular design of Translation Theory subjects.

2. Expected Learning Outcomes in Translation Theory Subjects

Among the changes resulting from the Bologna process and the implementation of the European Higher Education Area is the adoption of a new approach concerning teaching planning as well as the actual performance of teaching, i.e., the roles adopted by both the teacher and the students, in and out of the classroom. Without going into further discussion, as the rationale of this new approach and the main changes involved have already been extensively discussed, the shift of focus from the teacher to the student implied the incorporation of "learning outcomes" into teaching planning, instead of using the more traditional concept of "objectives".

The learning outcomes are statements of what students are expected to know, understand and/or be able to do at the end of their degree programme. The adequate definition of learning outcomes makes it possible to inform society and the students of the learning requirements established for each level; furthermore, learning outcomes provide employers with information about prospective employees' skills. (ANECA, 2013)¹

2.1. Intended Learning Outcomes in Translation Theory Syllabi

As stated in the previous definition, an adequate description of the learning outcomes enables students to get a (more or less) accurate idea of the rationale of a subject as well as its contribution to their training as future professionals. In spite of its limitations, due mainly to administrative and technical reasons, a review of the syllabi of Translation Theory subjects taught at Spanish universities in Translation degrees should thus provide relevant insights into the learning outcomes lecturers expect students to achieve.

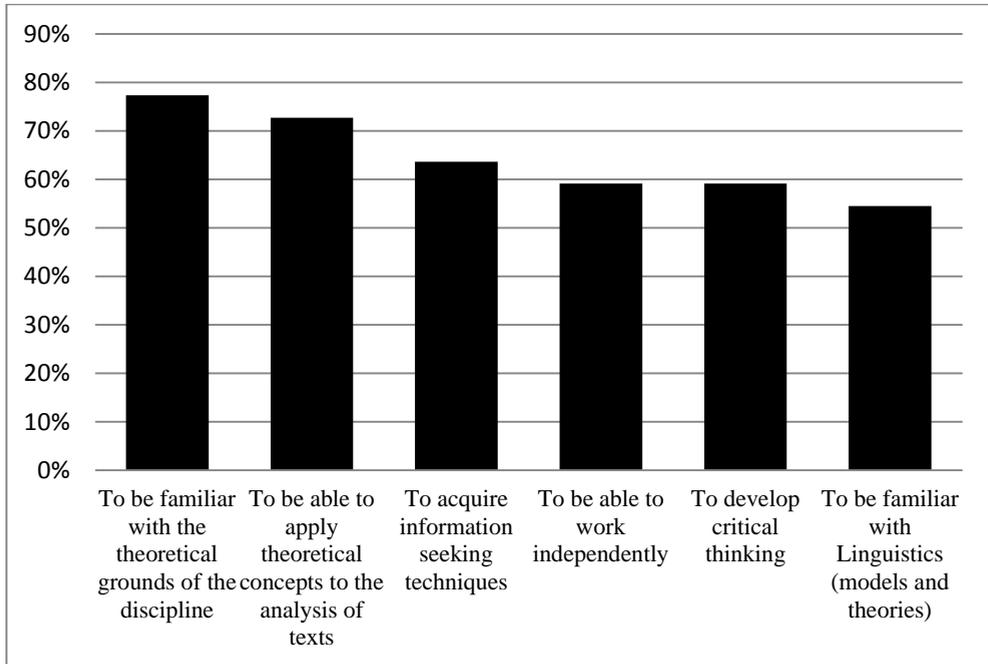
Table 1 shows the intended learning outcomes² most frequently included in the syllabi of Translation Theory subjects³, which reveal the existence of some confusion in the conceptual level regarding the identification of the object of study of translation theory; for instance, the acquisition of information seeking techniques (included in 63,6% of the syllabi) can hardly be directly related with the study of the theoretical component of translation. Furthermore, it is noteworthy the fact that the majority of the intended learning outcomes fail to contribute to reinforcement the existing connection between the theory and the practice of translation.

¹ Our translation.

² It should be noted that in the examination of the learning outcomes stated in the syllabi only those considered specific to the subject (competencias específicas) were taken into consideration.

³ There is a total of 22 subjects dedicated to translation theory (Agost and Ordóñez-López, 2016), according to the information provided on the webpages of the 24 universities which currently offer undergraduate study programmes in translation in Spain.

Table 1. Intended learning outcomes in Translation Theory Syllabi



2.1. Students' Expected learning Outcomes in Translation Theory Subjects

In an empirical study conducted at four Spanish universities⁴ (cf. Ordóñez-López and Agost, 2014 and Agost and Ordóñez-López, 2015), with a population of over 900 students, respondents were asked about what they consider to be the most important learning outcomes in theoretical subjects.

As shown in Table 2, the majority of students expect to acquire the competences which enable them to deal with translation problems and solutions (38.3%), followed by a good knowledge of both the field and the development of the discipline (20.8%). If level of studies is taken as the independent variable, one more interesting tendency emerges: students in their fourth year and those doing a research-based master's course give more importance to critical thinking (25.5% and 23.1%, respectively).

⁴ The informants were mainly undergraduate students and, to a more limited extent, postgraduate students, at four Spanish universities: the University of Granada, the University of Alicante, the Autonomous University of Barcelona and the University Jaume I.

Table 2. The most important learning outcomes according to students

	1st year	2nd year	3rd year	4th year	MRes	MA	PhD	Erasmus/exchange	No answer	Total
Familiarise themselves with the discipline and its evolution	39	53	55	39	3	2	0	2	0	193
Develop critical thinking	18	31	38	37	3	1	0	0	0	128
Systematise translation problems and solutions	120	104	78	38	3	4	0	8	0	355
Analyse translations (their own and others') using the appropriate terminology	52	43	17	12	1	3	2	0	0	130
Other	16	12	15	15	3	0	0	0	1	72
No answer	24	22	6	4	0	0	1	1	0	58
Total	269	265	209	145	13	10	3	11	1	926

3. Methodology in Translation Theory Subjects

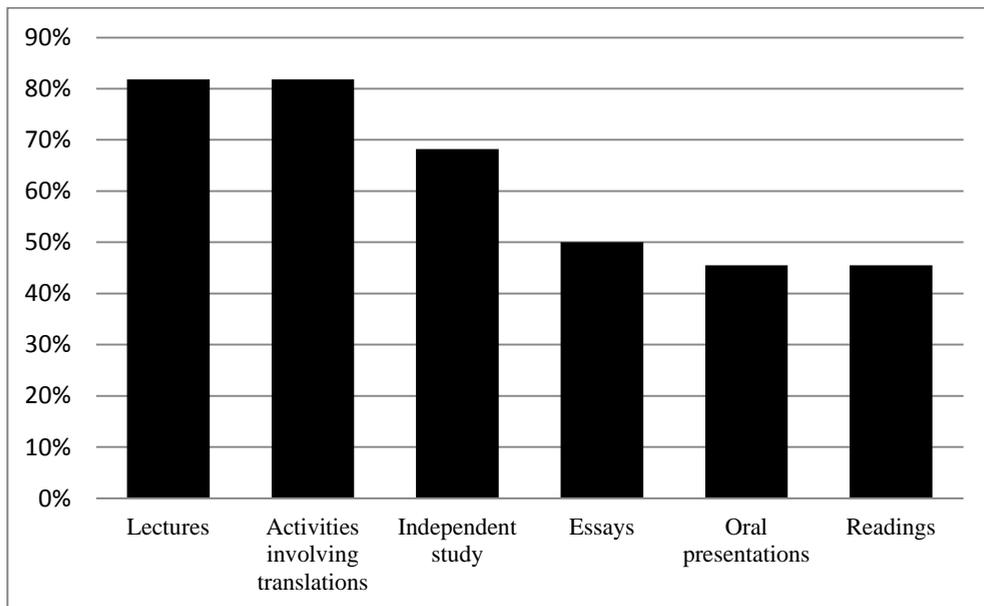
Teaching methodology is a key aspect in keeping students motivated; given the fact that translation degree programmes tend to be practice-oriented, it is even more important when it comes to the teaching of theoretical subjects to apply an appropriate methodology. The inherent applied nature of translation should be taken into consideration in order to adopt an adequate methodology, as well as appealing and relevant classroom activities. Again, the application of new teaching paradigms with the implementation of the principles guiding the EHA (European Higher Education Area), has involved the adoption of new methodologies which contribute to the development of a leading role by students, who should be enabled to construct and manage their learning process.

3.1. Intended Methodology in Translation Theory Teaching Planning

As shown in Table 3, the review of the syllabi of Translation Theory subjects reveals that the majority of lecturers applied a mixed methodology, combining traditional lectures (in some cases it is specifically stated that students' participation is encouraged) with practical sessions, which normally favour more active participation of students. Comparatively little attention is paid to tutorial session, which only appear in 41% of the syllabi examined, despite the relevance of this teaching method in the methodological shift experienced with the implementation of the Bologna process. Furthermore, it is important to mention that, in

some cases, when performing activities involving translations⁵, the translation itself is considered the main aim of the activity, rather than using translation as a means to raise the students' awareness of the theoretical models, strategies, methods, techniques, etc. that operate in the act of translating. It is precisely this aspect that makes the difference between a (general or specialised) translation class and a translation theory class.

Table 3. Teaching/learning activities in Translation Theory syllabi



3.2. Students' Expected Methodology in Translation Theory Subjects

First of all, according to the results obtained in our previous investigation (cf. Ordóñez-López and Agost, 2014), generally speaking, the majority of students perceive their role as being adequate, although 25.7% rate it as passive. Although these data should be compared with those from other subjects to get a more accurate impression, they suggest that there is room for improvement.

As shown in Table 4, 35.1% of the respondents prefer to carry out activities involving translations, followed by debates (19.3%), which require a higher level of cognitive demands and critical thinking from students. However, a significant degree of rejection of other activities that are also very taxing from this point of view, but which are carried out individually or outside the classroom, as part of the students' personal workload (such as reading, 7.6%; assignments or essay writing, 5%; reviews, 0.6%) can be observed.

⁵ The exact nature of these activities cannot be determined from the information included in the syllabi.

Table 4. Students' expected teaching activities in Translation Theory subjects

Level of studies	Preferred teaching activity in Translation Theory subjects									Total
	1st year	2nd year	3rd year	4th year	MRes	MA	PhD	Erasmus/ Exchange	No answer	
Readings	18	20	19	6	4	3	0	0	0	70
Debate	43	45	37	48	0	2	0	4	0	179
Online forums	6	4	1	1	0	1	1	0	0	14
Reviews	3	1	2	0	0	0	0	0	0	6
Oral presentations	11	6	7	4	0	1	0	1	0	30
Essay	14	15	13	2	0	0	0	2	0	46
Text analysis	6	12	3	5	0	1	0	0	0	26
Exercises involving translations	98	113	82	28	1	2	0	1	0	325
Other	69	38	43	50	8	0	1	3	1	213
No answer	1	11	3	1	0	0	1	0	0	17
Total	269	265	210	145	13	10	3	11	1	927

4. Discussion

Given the fact that translation study programmes are predominantly practice-oriented, the teaching of theoretical subjects can be challenging and demanding. Taken into consideration both the two-fold nature of Translation Studies and the students' expectations, efforts should be made to facilitate the successful integration of theoretical contents into the education of translators-to-be in the teaching planning (and subsequent implementation).

The results obtained in the examination of the syllabi of subjects on Translation Theory taught at Spanish universities reveal the existence of some problems, of an epistemic nature, related to the identification of the object of study of theoretical subjects. Furthermore, some teaching methods make it more difficult for students to adopt a central role and to perceive translation theory and practice as two interconnected dimensions of Translation Studies.

Concerning the (mis)match between the intended learning outcomes and teaching methods, on the one hand, and students' expectations regarding these two aspects on the other, considerable coincidence can be observed. "Being familiar with the theoretical grounds of the discipline" is the most frequent learning outcome in the syllabi and is also one of the most important aspects for students; however, some learning outcomes directly related with the professional practice of translation, such as the analysis of translations (their own and others') using the adequate metalanguage, appear to receive little attention in the teaching planning. With regards to methodology, "lectures" is the most commonly used method, although students' expectations privilege more applied and participative classroom activities, such as working with translations.

To sum up, in spite of the relative similarity between the students' expectations and Translation Theory teaching planning, there is still room for improvement in order to highlight the relevance of translation theory in the education of future translators, providing students with the necessary means to acquire valuable and fruitful insights into the theoretical dimension of translation.

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Innovative 3D Animations for Teaching Electromagnetic Field Theory and its Mathematics in Undergraduate Engineering

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Abstract

In this work, an innovative approach for the design and structuring of teaching videos systematically using 3D animations is presented. The approach focuses on the quantitative description of electromagnetic fields and the mathematical methods and competencies required for this purpose, exemplarily with regard to an undergraduate electrical engineering course during the initial phase of corresponding degree programs. An essential part of this course is the spatial and time-dependent description of electromagnetic fields. For this purpose, students have to work with multiple integrals in 3D space and in different coordinate systems. Such subjects are typically covered only later in mathematics courses and without a technical context, therefore leading to major difficulties for many students. The videos presented in this work are intended to support students and lecturers to work with these subjects in an instructive fashion. The 3D animations allow for effectively clarifying complex connections between technical and mathematical aspects. The videos and their specific design are discussed with regard to didactic and technical considerations. Additionally, their integration with existing interventions for the course is described.

Keywords: 3D Animations; Electromagnetic Fields; Electrical Engineering, Engineering Mathematics, E-learning.

1. Introduction

The quantitative description of electromagnetic fields usually requires students to work with multiple integrals in different coordinate systems. The application of corresponding integral equations is connected with comprehensive spatial reasoning in 3D space. The resulting complexity of such subjects leads to major difficulties for many students (Hennig, Mertsching, & Hilkenmeier, 2015). This is a particular issue when electromagnetic fields are covered in the initial phase of undergraduate engineering degree programs, where corresponding advanced mathematical subjects are typically addressed only later in mathematics courses. Electrical engineering degree programs cover electromagnetic fields in the initial phase because of their essential relevance for exhaustively understanding and describing most electrical phenomena, for example in terms of direct current networks. Additional challenges include restricted and heterogeneous mathematical expertise of incoming students, low self-directed learning readiness, and a different view on mathematics in comparison to school (Alpers *et al.*, 2013).

Common approaches to respond to these challenges are the establishment of bridging courses, mathematics support centers, and restructuring the curriculum (Biza *et al.*, 2016). While bridging courses are usually focusing on basic mathematical subjects, mathematics support centers are an additional and uncoupled intervention so that they are possibly not attractive. Restructuring the curriculum competes with the systematic development of theory in mathematics and engineering courses, respectively. In this work, video instruction systematically using 3D animations is presented as a partial solution to address above mentioned challenges. The videos are integrated with existing interventions for an undergraduate electrical engineering course, therefore not appearing as an uncoupled intervention. Additionally, time and place-independent learning are facilitated.

In comparison to the 2D case, 3D animations and visualizations allow for clarifying problem statements in 3D space “as they are”. Reduced simplifications, such as 2D cross sections, are avoided. For example, if the 3D symmetry properties of a 3D technical setup have to be analyzed for mathematical modeling purposes, a 2D simplification might complicate this process. 3D studio animations as presented in this work can also be used to visualize technical models of electromagnetic fields, for example field lines of electric or magnetic flux, together with mathematical modeling aspects. In reality, such properties cannot be visually observed directly but only by indirect effects, such as forces between charged objects. This might lead to difficulties for students to build dynamic mental 3D models of electromagnetic fields. When the videos are integrated with the course, corresponding mathematics can be presented directly in the technical context and with a consistent mathematical notation. This is in contrast to mathematics courses, which are often taught “as a service” by mathematics departments to students from various fields, therefore changing notations and the lack of technical contexts might be an issue.

2. Didactic Classification

The wide-spread interest in Massive Open Online Courses (MOOCs) and flipped-classroom approaches in recent years motivated further analysis of different production styles of video instruction in the literature. In (Guo, Kim, & Rubin, 2014), the authors distinguish between six different video production styles, of which the so-called Khan-style (freehand writing on a digital drawing board with audio commentary, as extensively used by Khan Academy) and video capturing of class teaching are probably most common. To the best of the knowledge of the authors of this work, the specific production style and structuring of the videos presented in this work (systematic usage of 3D studio animations covering complex connections between technical and mathematical aspects) are not described in the literature. This is why the videos presented in this work are referred to as being innovative.

In general, it can be stated that multimedia animations and presentations can be an effective instrument to enhance the learning process. Nonetheless, it remains unclear under which principal conditions (such as specific learning goals) different production styles of teaching videos are most effective (Clark & Mayer, 2016). For example, it has not been investigated in which cases 2D animations are more effective than comprehensive 3D animations. On the contrary, 3D animations and visualizations are used in science and engineering education since many years (Gilbert, 2005; McGrath & Brown, 2005). Particularly representative in this context is the usage of 3D anatomy models in medical education. These are intended to support building dynamic mental 3D models of anatomical structures (Azer & Azer, 2016). Similarly, 3D models of complex molecular structures are used in chemistry education, while 3D visualizations of geologic structures are used in geology education (Gilbert, 2005). Considering electromagnetic field theory, Dori and Belcher (2005) developed a broad range of 3D visualizations (also with a focus on student activation) for an introductory electromagnetism course. While the authors conclude that 3D visualizations can enhance the conceptual understanding of the course contents, they are not focusing on complex connections between technical and mathematical aspects.

Niss and Højgaard (2011) elaborated a set of eight characteristic (but mutually connected) mathematical competencies which can be necessary to work with mathematical problems. The videos presented in this work are explicitly focusing on three of these competencies in relation to the technical course contents (situated). To be more precise, the competency to handle mathematical symbols and formalisms, mathematical modelling competency, and the competency of mathematical reasoning are addressed. Referring to this, the competency to handle mathematical symbols and formalisms comprises the ability to decode and interpret symbolic mathematical language. For example, this competency is necessary to correctly choose the specific geometric object, such as an open or closed contour or surface, over which different multiple integrals have to be evaluated. The mathematical modelling competency involves the ability to translate (mathematize) objects and relations to a

mathematical form as well as to work with the resulting models. For example, mathematical descriptions of infinitesimal elements of specific geometric objects have to be built to be used as differentials within different multiple integrals. In order to evaluate the resulting multiple integrals, it is necessary to be able to reason mathematically. For example, if the variables of a function to be integrated do not depend on the integration variables, these can be written in front of the integral so that the integration is simplified.

For the design and structuring of the videos presented in this work, among other considerations, the evidence-based *principles of multimedia learning* (Clark & Mayer, 2016) are taken as instructional guidelines. The principles are based on the cognitive theory of multimedia learning which models – broadly formulated – information processing and integration when learning with multimedia instruction. In this theory, a multimedia presentation consists of words which can be written or spoken, and pictures which can be static or dynamic. The material presented is then processed by a separate visual and verbal channel, each with limited capacity. Finally, in order to achieve deep learning, active processing of information is necessary. This involves the selection, organization and mutual conversation of words and pictures. The application of the *principles of multimedia learning* derived from this theory is described in the next section.

3. Video Design and Structuring

The design and structuring of the videos presented in this work are exemplary described for a video about Gauss's law in electrostatics, see fig. 1 and fig. 2 in appendix for example images. The equation (right side in fig. 1a) states that the integration of the electric displacement field \vec{D} over a closed surface A equals the therein enclosed free charge Q . In this example, Q is given by a spherical volume charge with radius R positioned in the origin of a Cartesian coordinate system. The video remains focused on this arrangement and does not include extraneous material (*coherence principle*). Explanations are given by audio comments and are not written on the screen again (*modality/redundancy principle*).

In order to apply the integral equation correctly, it is important to understand the concept of enclosed charge. This is why it is shown that a volume charge can be considered as an arrangement of many point charges (left side in fig. 1a). This leads to the conclusion that \vec{D} has to be calculated outside ($r > R$) and inside ($r \leq R$) the volume charge separately, where r is the distance from the coordinate origin. The currently considered case is always specified at the top left to highlight the organization of the video (*signaling principle*). Next, a 3D symmetry analysis identifies the electric displacement field to be radially symmetrical and to only depend on r (fig. 1b). It is therefore advantageous to describe the field in spherical coordinates to obtain a compact mathematical description. The spherical

coordinate system is covered earlier and not included in this video (*pre-training principle*). The captions for the displacement field, the axis and other objects are positioned closed to their corresponding elements to point out their spatial contiguity (*spatial contiguity principle*). The animations are oftentimes segmented and stopped when giving long explanations or when explaining mathematical evaluation steps (*segmenting principle*).

Due to the spherical symmetry properties, it is advantageous (simplification of evaluation steps) to use a sphere as a closed surface. This process is illustrated in fig. 1c. It is now important to understand the correct formulation and the meaning of an infinitesimal area element in 3D space to be used as differential $d\vec{A}$. The verbal explanation and mathematical description (model) are presented simultaneously (*temporal contiguity principle*). The intervals of the integration variables (integration limits) have to be selected so that the spherical surface is completely closed. An animation illustrating this is shown in fig. 2a. Note that such a process cannot be visualized in 2D. After explaining the evaluation of the integral (fig. 1b), the electric displacement field is calculated inside the volume charge. In comparison to the outside, the enclosed charge depends on the dynamic size of the closed surface. This concept is visualized by an animated shrinking of the surface. Finally, the resulting field description is presented (fig. 1c.).

The videos have a length of approx. 6 minutes (as suggested by Guo, Kim, & Rubin, 2014). The audio comments are spoken by an experienced lecturer in conversational style based on a pre-written script (*personalization/voice principle*). It is intended to avoid the impression that the speaker himself does not understand the video contents (which might be the case for a professional speaker). The production of the videos is based on a script with draft sketches. For producing the videos, the open-source software *Blender* is used.

4. Conclusion and Future Work

The videos presented in this work allow for a comprehensive presentation of complex connections between technical and mathematical aspects in 3D space. Using traditional 2D animations and visualizations, such a dynamic presentation appears to be difficult.

The videos are integrated with an existing web-based learning platform. This platform is used within and outside the face-to-face courses to implement a blended learning scenario (for details see Hennig, Mertsching, & Hilkenmeier, 2015). The connection with activating elements (cf. Loviscach, 2014) is planned. An important next step is the systematic evaluation with regard to the acceptance and effectiveness of the videos, especially because of the limited research available for such specific videos.

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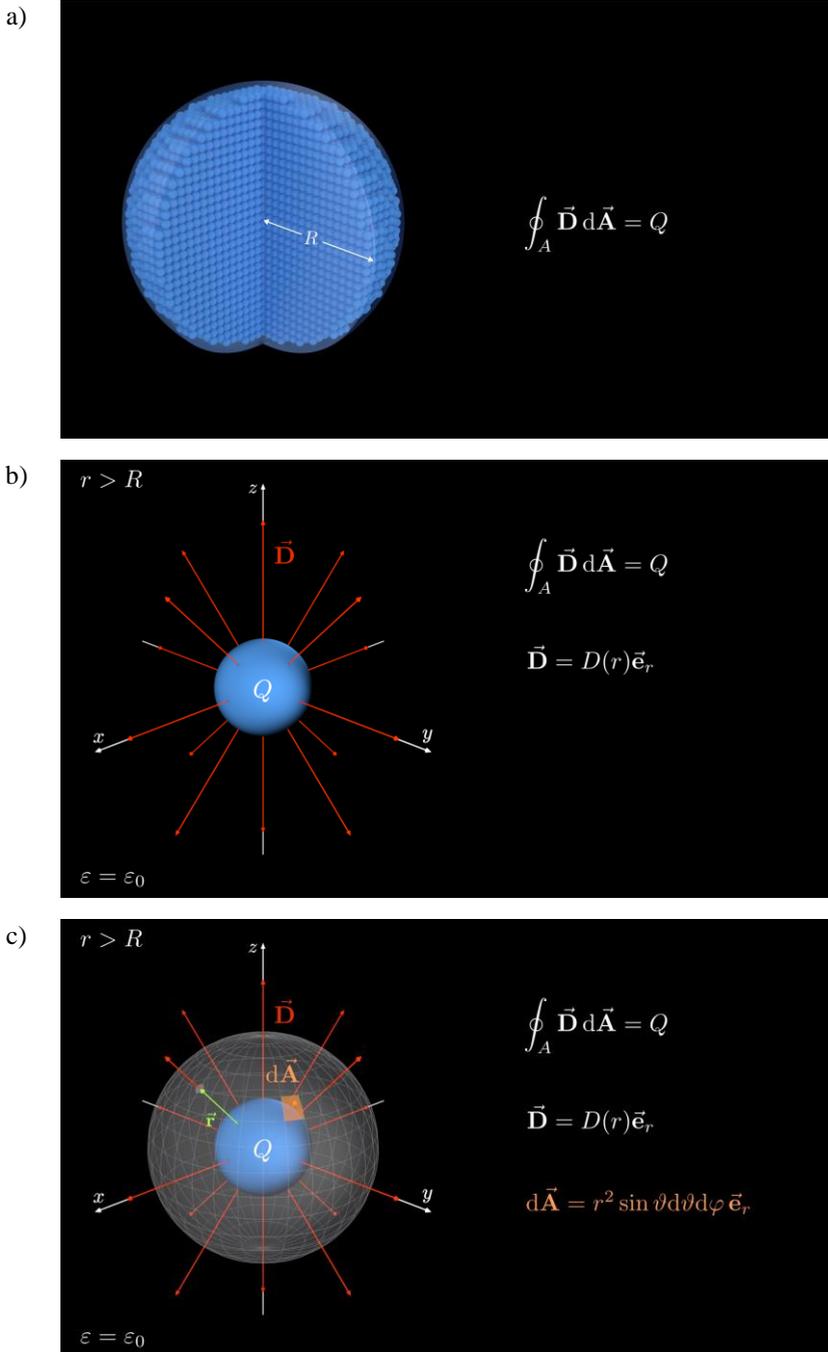


Figure 1: Selected frames from one of the teaching videos developed in this work, see text for details.

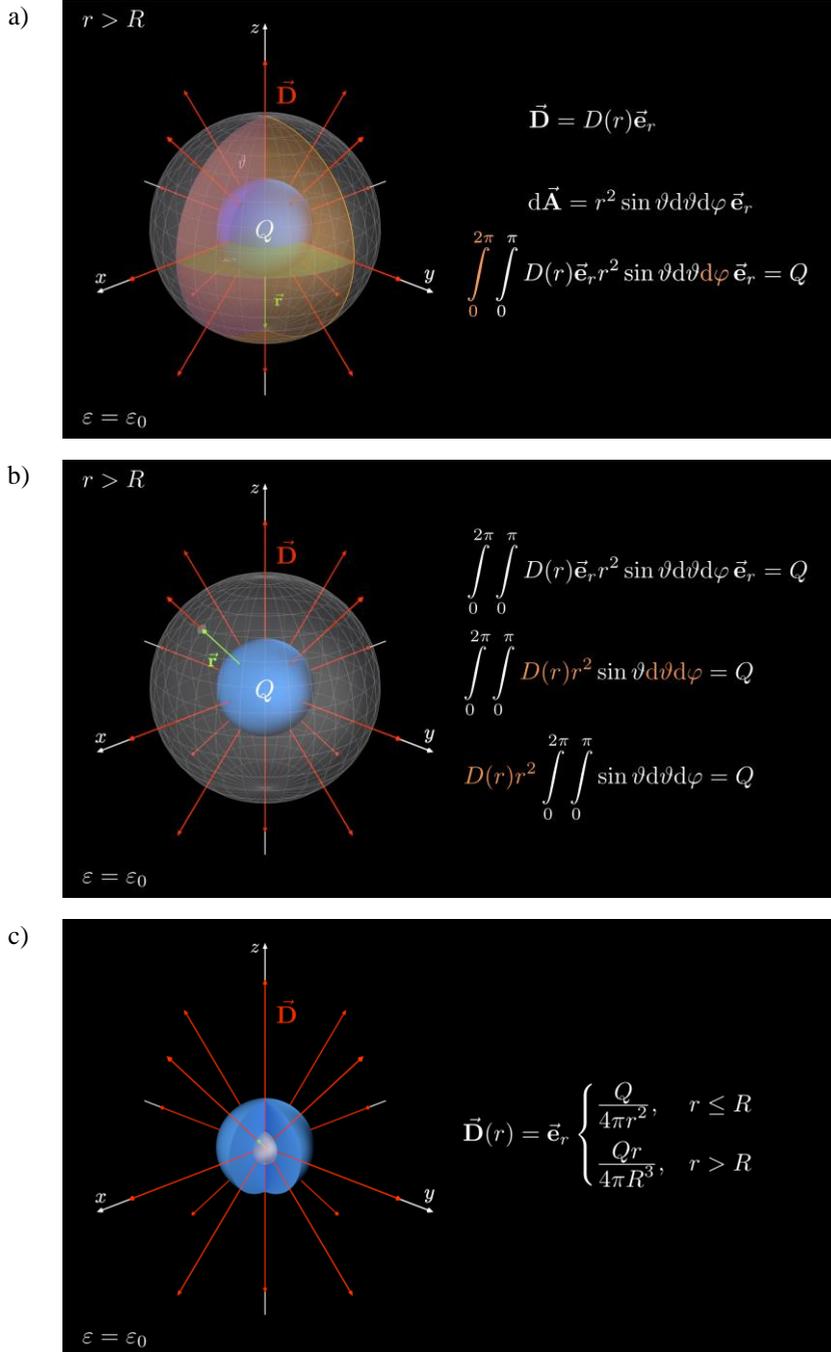


Figure 2: Selected frames from one of the teaching videos developed in this work, see text for details.

“Nobody is strange”: mobility and interculturality in higher education from the viewpoint of a group of Portuguese international music students

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Abstract

The benefits of mobility are often related to the development of skills and competences on the adaptation to new environments and organizational forms, foreign languages, and cultures in general. In the specific case of the international students, mobility enhances the view of the institution of higher education as a global and intercultural learning space, which promotes the exchange of ideas, resources and opportunities for experimentation, global citizenship and professional opportunities. Nowadays we assist to a rising number of international students, a fact that deserves special attention and makes us turn our interest to what our own (Portuguese) international students believe as being important not only in their actual experience, but also relevant in its intercultural dimension and their academic and professional success. Henceforth, after theoretical considerations about mobility and the intercultural experiences amidst the internationalization of higher education institutions, our communication presents part of the results of a broader study focused on viewpoints and perspectives of a group of Portuguese international music students, about their intercultural experience in a foreign country and its relationship with academic success.

Keywords: *Mobility; International students; interculturality; globalization; Higher education; music students.*

1. Introduction

Universities have a long history of international relations and transnational activities and in recent decades, the processes of globalization have accelerated the internationalization of higher education institutions. Today, the promotion of internationalization is a main pillar of higher education, with a growing investment in the recognition of joint degrees, transnational research teams and other activities of an international character.

Mobility is another feature of the knowledge societies that higher education institutions recognize and foster by encouraging the international mobility of the academic community through exchanges for scientific and cultural enrichment. More specifically, universities, that since its foundation have been committed to mobility, highlight the centrality of this idea, which is regarded as "... a key opportunity for learning and development" (Eurostat, 2009, p.106). Throughout several student exchange programs, such as Erasmus, created in 1987, 2.5 million students were allowed to study abroad, a number that is low, if we consider the goals of the H2020, that 20% of mobility should be reached (Moor & Henderikx, 2013). Consequently, there is a significant growth in the numbers of international mobility, which increased from 2.1 million in 2002 to 3.4 million in 2009 and 4.3 million in 2011 (OECD, 2013).

Another no less important aspect of mobility relates to the incubation of intercultural environments. International environments, by virtue of the creation of open spaces where the circulation of ideas from different disciplines, places and contexts prevails, as well as the trust and friendship between individuals of different nationalities is nurtured, are recognized by its predispositions and potentialities to advance thinking and acquisition of new knowledge, attitudes and skills, alongside the creation of new relationships and informal learning that fosters the emergence of intercultural settings (Moreira, 2013).

Since one of the indicators of the level of internationalization of higher education institutions is both the number of international students and the buildup of intercultural competences, the increase in the number of international students is noticeable, which leads us to focus in what the students themselves emphasize on what they are experiencing, regarding the importance of the intercultural dimension in academic success.

After theoretical considerations about mobility and the relevance of intercultural experiences in the context of the internationalization of universities, we present perspectives and ideas of a group of international Portuguese students in the music field, on the impact of the intercultural dimension on their educational success, namely by questioning about the integration processes in the new social, cultural and academic environments, and on the conditions and level of involvement in the process of acculturation. As these young adults experienced the process first hand, we intend to know

about the experience that has occurred, to deepen and broaden the knowledge of this reality and present other potentialities to intervene.

2. Mobility and the experience of diversity

International mobility has been increasing the opportunities for cultural exchange and a regular contact between individuals and groups - distance or face-to-face - has been consolidated, acting as a way to transform personal, social and cultural experiences by exposing individuals or groups to horizons of knowledge and experiences that, in general, would otherwise be impossible. Due to the intensification of mobility, the daily encounters between local and global cultures encourage awareness of diversity and clearly discern the coexistence and interdependence between differences, highlighting the requirements for both learning about human interaction and acquiring intercultural competencies. As Gardner (2004, p. 254) notes, “knowledge of and ability to interact civilly and productively with individuals from quite different cultural backgrounds both within one’s own society and across the planet”, is one of the challenges for education in a global era.

In regard to the production of scientific knowledge, the mobility of students and teachers is also considered a promising factor of innovation and creativity, since research is strongly related to both the global science and the international markets.

In addition, since the labor market itself is multilocalized, enriching itself and acquiring new contours through the international contexts where it is immersed, the importance of intercultural contacts for social and economic development is increasingly recognized as they provide and make advance: "i. The learning of tolerance and of living with diversity; ii. The recognition of the diversity involved in international and global relations; iii. And the sedimentation of an European identity, in addition to national diversity (Eurydice 2004, p.57). However, this situation of multiculturalism in contemporaneous Europe, rather than being a state of affairs, is a social construction whose true meaning for intercultural relations requires the will of the parties involved (Southcott & Joseph, 2010).

3. International students, interculturality and internationalization

As OECD (2014) states “The term ‘international students’ refers to students who have crossed borders expressly with the intention to study” (p.78). The reasons that lead to the growth in international students are mostly related to the value that higher education has acquired, particularly when the diplomas are from prestigious institutions, or even when students can not continue their studies in their home country. In effect "Within OECD countries, 27% of students enrolled in doctoral or equivalent programs and 12% of those

enrolled in master's or equivalent programs are international students" (OECD, 2016, p. 329). In addition, both mobility and number of international students continue the most stable indicators of the level of internationalization of higher education institutions that is also noted throughout the heterogeneity of international students which is an advantage for local students (Urban & Palmer, 2014; Moreira, 2016).

The internationalization of higher education is undergoing a new phase that includes the mobility of students and teachers for academic purposes, as well as the development and marketing of the commercial dimension of educational services (Wadhwa & Jha, 2014; OCDE, 2016). In addition, international student destinations are also changing as the USA is no longer the preferred destination, and especially at postgraduate level there is a growing number of personal and family funding (around 46 %). According to Wadhwa (2016) this new phase presents yet another characteristic that is associated with: the shifting work scenarios that require new and specialized knowledge, "the search for better living conditions and a stronger labor market demand" (p. 231).

Finally it is necessary to mention the countless fears, anxieties and challenges that international students face in the process of adjusting to a new culture, which can be briefly summarized as: language barriers; cultural shock; homesickness; adjust to a new academic environment that requires a different kind of work, and adjustments to a different teachers' role and classroom dynamic (Croese, 2011).

4. Methodology

In the study that follows, the participants constitute a group of 10 students, from Portugal, mostly male and under twenty five years old, who continued their musical training in Germany. The constitution of the group obeyed the following criteria:

- have left Portugal to study music abroad;
- be or have been a music student of a brass instrument at an higher education institution in Germany during the period between 2010 and 2014.

Each one of the participants was interviewed. One of the topics addressed was related to the multiculturalism in the German higher education institutions where these participants were enrolled and the recognition of the value attributed to this phenomenon. The intervention of these institutions in the process of foreign students' adaptation was also addressed, as well as cultural values of the country of origin and the country of studies, seeking to know how the integration has been developed and what levels are achieved (Antão & Moreira, 2016).

These students have chosen to pursue studies in Germany, regardless of the external financial support they have been given. This situation is common given the number of

students joining German music universities each year. Also, all students are freelance independent musicians as they take advantage of some opportunities during their studies to gain professional experience and financial return for their studies.

5. Results and Discussion

German society was recognized as definitely more multicultural than the Portuguese and the German citizens characterized by their independence and individualism, adjectives that were noted as positive traits. The interviewees also described the Germans as highly organized, rigorous and, in general, with greater control, to which they added an initial coldness that dissipates after a greater personal conviviality. An interesting idea left by one of the interviewees was the relativization of the meaning of the word “compatriot”. If the former thought that colleagues coming from different areas of Portugal could be distant in cultural terms, after the experience in Germany, this concept was relativized, finding this interviewee all Portuguese very close in their identity as compared to other cultures.

In speaking about the challenges of living in a new culture, respondents revealed a consensus in choosing language as the main factor of detachment in reaching the new culture. In analyzing the new society, some interviewees felt the need to be more organized and to be very responsible, something that has already characterized the environment. It was also highlighted that the pupils went to the host country as - in part - to the “unknown”, since not everyone had a clear idea of what awaited them, being a reason of initial concern, that defies the discovery. In the same sense of discovering German society, the interviewees refer to a notorious diversity of cultures that was seen in a very positive way, also stressing the fact that being away from the family is as an inevitable challenge, notorious from the outset. Still referring to the characterization of the cultural environment, common ideas emerged from the interviewees, which should be highlighted:

[...]if you want to study in a school or even at a professional level, you have to master the basics of the language. [...] the culture, the form ... the character of the Germans, is a little different from the Portuguese, people are cooler, more square, everything is planned ... but it is a matter of having an open mind and [...] with time you adapt to the new society.

In addressing the issue of multiculturalism, the answer could not have been clearer: both the society and each of the students’ classes were considered to be multicultural. The theme of multiculturalism made the interviewees associate their ideas with other concepts such as understanding and openness, the keys to an intercultural dialogue. Although learning in multiculturalism can be a highly complex subject, there is an express intention of the interviewees to approach the German culture. The interviewees point out that the benefits

of multiculturalism begin with the stimulating environment, since students from different cultures are coming out of their home country at about the same age, thus promoting reciprocal contact, given the similarity of conditions (and motivations). In this context, one interviewee points out that in intercultural dialogue, care must be taken not to cause misunderstandings resulting from cultural differences, to which another interviewee notes the fact that there is a special learning in dialogue, playing with the different languages in the class and thus learning with each other, while socializing. Simultaneously they refer to the openness and acceptance needed to deal with other cultures, while recognizing that there are many different styles of playing music among students of different cultures. Regarding the school institutions, it is evidenced the reduced number of Germans in the school environment, comparing with Portugal, where the number of foreign students is small. As one student notes

[...] This is very multicultural ... there is no one strange, [...] any aspect that is different, is seen as something that is from your country, ... is understood.

In relation to the intervention of the school institution in the process of adaptation of the foreign student, the opinions diverged, being that in some cases there is an active intervention of the university in the adaptation of the student, but in others it is mentioned the inexistence of platforms and activities designated for this purpose. However, there is a greater number of financial support (scholarships) for students in German universities, which in the Portuguese case is practically non-existent. It was also mentioned the dynamic nature of the music courses, such as orchestra and chamber music, where the process of interaction between students can be more naturally stimulated, and such the student's adaptation facilitated.

6. Final Considerations

In general, these results are in line with those of other investigations. We can conclude that the expected benefits of pursuing cross-border studies may even lead to increased financial burdens, a trend that has intensified in the new phase of internationalization of universities (Wadhwa & Jha, 2014). In the first place, the change of country to pursue studies is a considered decision and involves a significant effort on the part of the students, and therefore also requires a commitment that is possibly greater than if they continued their studies in Portugal, since the change of a country involves adaptation to a different culture and society, as well as to a new education institution, teachers and culture of teaching. In other words, the challenges inherent to the process of immersion in the new culture, that makes the study experience very intense, were pointed out by the Portuguese students in Germany, in a similar way to those described in the literature (Croese, 2011). In addition, the

characteristics of the cultural setting were mentioned as belonging to the group of factors more determinant for the success of the Portuguese students in Germany.

We can conclude that the process of acculturation is determinant for the academic success of the music student and to the fact that successful adaptation and integration is seen as a facilitating role of professional success as well. In our case study, due not only to the number and places available for professional development, but also for the safety of work, the cultural and professional environment are also of highest importance for the students. As for the need to approach the host culture where the students are pursuing their studies - in general - and in the case of the Portuguese students - in particular -, it was clear that, without being able to ensure generalizations, it should be of benefit to any foreign student, regardless of its origin.

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Gamification in teaching Maintenance Engineering: A Dutch experience in the rolling stock management learning

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Abstract

The aim of this study is to evaluate the application of an innovative serious game, based on the asset management of rolling stock, in the training of future maintenance engineers within the master course in mechanical engineering at the University of Twente. The Logistic Support Game (LSG) is a serious game developed together with Netherlands Railways (Nederlandse Spoorwegen, NS) and Invoke (design firm) as a tool to simulate the maintenance operations of a fleet of trains. The simulation shows four perspectives: the operations manager, the asset manager, the maintenance manager and the financial manager.

The three goals of this innovative training are the improvement of student engagement in the learning process, the increase of active cooperation between students with different roles in a group, and the opportunity to receive feedback on decision making. To indicate achievement of these goals, they are linked to the basic needs of learning: competence, relatedness and autonomy.

A total of thirty six students played the serious game in two different sessions. At the end of each session, a survey is collected for game based learning assessment. Results suggest that the serious game has a positive impact on student engagement, cooperation, and helps transfer course contents.

Keywords: *Serious Game; Gamification; Emerging Technologies; Maintenance Engineering; Asset Management; Master students;*

1. Introduction

Games have been used for centuries for purposes as broad as forecasting, learning or entertainment. Game Based Learning (GBL) refers to the use of games as tools to support learning. Introducing game mechanics --gamification-- through a serious gaming tool aims to transfer course content in a way that is engaging, active and fun.

There is a large amount of empirical evidence of the positive outcomes of playing games. These outcomes can be knowledge acquisition, perceptual, cognitive, physiological, social and behavioural (Boyle et al., 2016). Results of the extensive survey by Boyle et al. (2016) also show the growing popularity of games for learning science, technology, engineering and math subjects. Moreover, serious games can be beneficial to student engagement, cooperation, and help transfer course contents. Section 2 further discusses benefits of GBL with a strong attention to board games, less represented in the literature than computer games.

The purpose of the research is to discuss the experiences with one such tool for teaching maintenance engineering master course at the University of Twente. The classroom experience is based on a serious game called the Logistic Support Game (LSG), developed in collaboration with Invoke and the Netherlands Railways (Parada Puig, 2015, Ch. 7). The game is a physical board game through which students make management decisions to maintain a fleet of rolling stock. Learning assessment is addressed as embedded formative assessment in the game, and external summative assessment in the form of a feedback session. The aim and the main features of the game are detailed in Section 3. Data from two different sessions with a total of thirty six students is collected and analysed. Section 4 discusses the results. Finally, section 5 presents the research conclusions.

2. The benefit of using serious games

Many different results are found about the effectiveness of Game Based Learning (GBL) (Crocco, Offenholley & Hernandez, 2006); it is widely accepted that GBL can be a motivator for students (Garris et al., 2002) and it has the potential to support deeper learning (Crocco et al., 2006). Depending on the design of the serious game, GBL can be linked to all three of the basic needs of learning of Deci & Ryan (2002): competence, relatedness and autonomy.

Competence is about the feeling of being efficient (Deci & Ryan, 2002). Receiving feedback can support the students in this feeling. Furthermore, it is important to include feedback in the design of the game, to help the students to immediately know the result of their actions (Hulme, Kasprzak, English, Moore-Russo, & Kemper, 2009). According to Westera, Nadolski, Hummel & Wopereis (2008), this type of feedback is called “strategic

performance feedback” and it gives the students feedback on their progress in the game instead of directly on their learning outcomes.

Increasing relatedness can be done in several ways. Firstly, by letting the students feel they are part of a group/community (Deci & Ryan, 2002; Smith, Sheppard, Johnson & Johnson, 2005). Secondly, by relating the educational settings to the real world (Deciand & Ryan, 2002). Thirdly, adopting real cases. Callaghan et al. (2013) describe the positive effects on the engagement of students by implementing a serious game or simulation game in which the students collaborate in groups and, or if they are in competition with each other (Westera et al., 2008; Hulme et al., 2009).

The autonomy of the students relates to the perception of amount of personal say they have in their own learning (Deci & Ryan, 2002). In a serious game, the students play by rules of the game but they can determine their own actions feeling freer to experiment with different decisions and to practise their skills for the real world (de Freitas, 2006), due to the lack of (real) consequences in a game (Hulme et al., 2009).

Based on the links between the basic needs for learning and student engagement, GBL definitely is an interesting method in teaching students. It comes down to the design of the game.

2.1. Benefits of Game Based Learning

Research shows that games that are designed for a specific course are more efficient than commercially developed games (de Freitas, 2006). Several serious games are computer based and evidence for the effectiveness of board games in higher education is limited (Lean, Moizer, Towler & Abbey, 2006). But, it is known they are implemented in different disciplinary fields (Lean et al., 2006). One of the positive examples is the board game developed and researched by Holweg & Bicheno (2002). Their experiences were that the impact of the chain supply game was more effective than general developed educational games.

“They had three reasons why they think the game was a success in an educational setting. Firstly, the results and learning points are directly transferable into the practice. Secondly, the direct interaction of the players and their direct experience has proven to be a great advantage in helping to explain key concepts to the players. Thirdly, the specific simulation model allows the players to experience the system from a different perspective than the one of their own company by playing any other station in the system” (p.173).

However, does this also apply for master students in engineering programmes? According to Callaghan et al. (2013), Hulme et al. (2009) and Clapper (2016) this is the case. When specifically looking at engineering education it is stated that: ‘it is vital for students to have peer support and to be active learners, not only so that more of them learn the material at a

deeper level, but also so that they get to know their classmates and build a sense of community with them' (Smith, et al., 2005, p.11).

3. The Logistic Support Game (LSG)

The LSG was developed to explore and support new asset acquisition strategies. The game addresses the primary question of whether to buy assets that match an existing maintenance infrastructure, or (re)-design the maintenance infrastructure in such a way that it matches a newly acquired asset. In this context, the game helps by providing an overview of the complexity of managing assets and their maintenance infrastructure. The LSG allows players to safely explore and evaluate various acquisition strategies and scenarios.

While the game was originally intended for decision makers (i.e. management), this research also applies it in education. In this context, the focus of the game is not on strategic decision making, but on gaining insight about the complexity of the supply chain, and about the roles of each stakeholder involved. This application is further discussed in Section 4.

3.1. Game components

The LSG is a board game consists of four primary components: a game board, train cards, maintenance stations and the maintenance schedule. The game board features 3 fictional cities (A, B and C) connected by train tracks. The board is used to visualise the allocations of trains to each route (i.e. a connection between city A and B, B and C or C and A) and the distribution of maintenance stations within the infrastructure. Train cards represent different types of trains, each with its own price, capacity (number of passengers), reliability and maintenance profile. Maintenance stations represent repair locations for trains. They are allocated to a specific location on the game board, and are equipped with a specific set of repair tools chosen by players during the game. The maintenance schedule is used to plan the maintenance and overhauls of the entire fleet of trains optimising the uptime as a whole.

3.2. Gameplay and strategic challenges

The game is played by a group of at least 4 players and 1 trained facilitator. Each player is assigned to a specific role of rolling stock operations manager, fleet manager, maintenance operations manager and financial manager, that is linked to each game component. Together, the team is responsible for transporting passengers between cities A, B and C on the game board. A game session features one or more scenarios: a configuration of maintenance stations, a fleet of trains and a maintenance schedule. In each turn the team has to find a balance between the passenger capacity demand (which may vary throughout the scenario), their train fleet and the maintenance infrastructure.

Each turn consists of the following steps: investment, doing maintenance and collecting revenues. Investment is based on the current settings and passenger capacity requirements, the team has the opportunity to invest, for instance in additional maintenance stations, addition tooling or new trains. Doing maintenance implies that all trains requiring maintenance can be repaired or overhauled, assuming sufficient maintenance resources are available. The team collects revenues for the number of passengers they transport. Passengers can only be transported on available trains, and trains can only be available whenever sufficient maintenance resources are available. The revenue depends on the availability of the train fleet. The next turn begins after collecting revenues.

The team's primary objective is to achieve a stable (or even profitable) system; revenues should cover investments and maintenance costs. To achieve this, the team has to consider the maintenance profile of each train card (regular repairs, overhauls and end-of-life), the features of the maintenance station ('A-type' train can be repaired only in 'A-type' repair stations) and customer satisfaction (which affects the long-term passenger demand, and therefore potential revenues). Teams can reflect on their strategies and decisions in a post-game discussion, using the scoring sheets as a starting point. The discussion explicitly relates turning points in the scores to decisions made by the team, and asks the team members to reflect on their actions as external summative assessment.

4. Experience from the master specialization in Maintenance Engineering

The aim of LSG is to simulate the management of a specific asset (rolling stock) through its entire life cycle and to evaluate possible new strategies within the company. However, as highlighted in Section 2, above, serious games also provide remarkable pedagogical and educational opportunities. Games can transfer right contents and important information through active learning. Active learning improves student engagement during the lecture, and increases the cooperation between the students within the group having different roles in order to achieve a specific task.

4.1. Better engagement, understanding and competition: the game session organization

The LSG sessions are planned for a duration of 90 minutes. Each session is split into two parts, each consisting of 45 minutes. The first part begins by transferring the message, information and game rules to the students during the first 30 minutes, and ends by making students play a first test round of 15 minutes with the help of the facilitators. One facilitator is assigned to each group. In the second part of the session, participants play the game independently during 45 minutes. During the second part, facilitators can only ensure that the game rules are followed by each group. To encourage students playing seriously, and to increase the fun, the second part of the game session is organised as a competition between groups. The results of every game round are tracked by the facilitators of each group and

shown on the main screen of the room. Figure 1 displays one game session with the score and investment results.

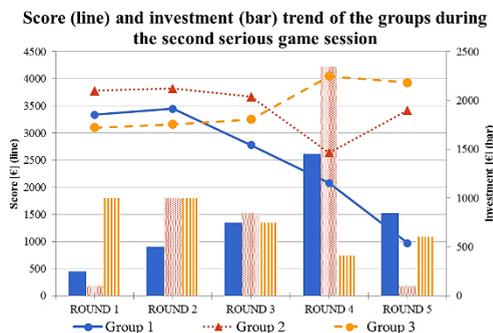


Figure 1. A moment during the second game session (left) and the score and investment results after 5 rounds (right)

Data is collected from two sessions. In the first session (21 students) 5 groups played the game and in the second session (15 students) 3 groups played the game. Each group is formed by 4-5 students. As highlighted in the score trend in Figure 1 (right), every group usually has its own starting strategy with different types of investment in terms of trains and maintenance workshop acquisitions. It is interesting to notice the effects of these initial strategies on the final scores. For instance, Group 3 starts with a high investment strategy (backup trains and maintenance workshop acquisition) and never experiences financial troubles in the later rounds of the session without risking bankruptcy.

4.2. Evaluation on the serious game sessions: a students' survey

Even though the informal feedback of the students is extremely positive both for the level of engagement and for the received learning information, a more scientific method to assess those impressions is adopted. A survey is conducted at the end of each session. Even if the data set (36 students) is not statistically robust, it can give an indication about the perceived engagement of the users, and about the performance of active learning in terms of provided information on the asset management study topic.

The questionnaire had 6 closed questions based on a Likert scale version (range of value from 1-very negative to 5-very positive) as psychometric tool to grade the responses. The feedback results of the two game sessions are summarised in the spider graph of Figure 2. The values represent the percentage of the possible score reachable for every posed question.

As shown, the distributions of the obtained results in the first and second session are similar, suggesting a homogenous perception and a strong coherence among the opinions of the students. An interesting result to discuss is the shared suggestion to not extend game

session; according to the survey, the time session was enough to engage better and to transfer the right information in terms of competences and learning goals.

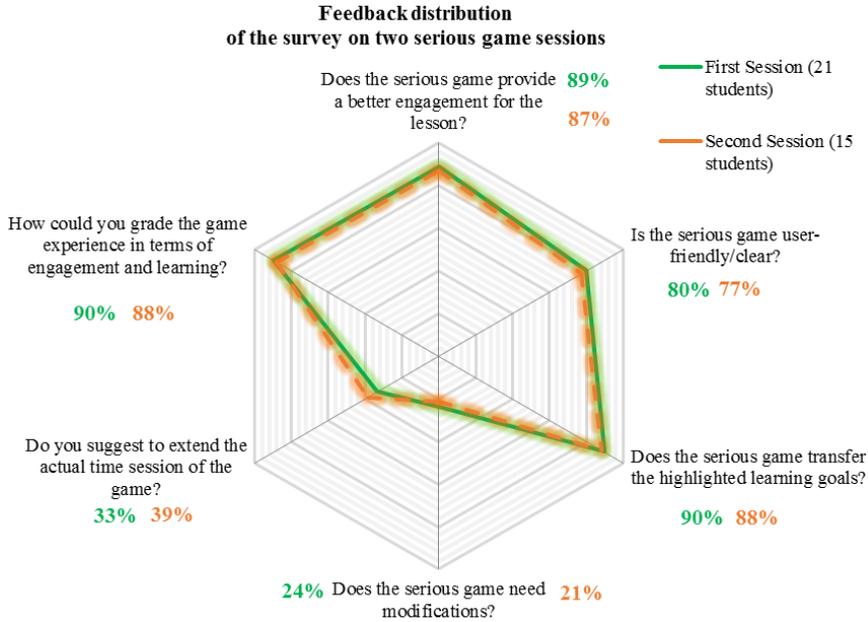


Figure 2. Feedback distribution of survey proposed to the students in each session

5. Conclusion and further applications

GBL offers indeed a huge tool to improve the active learning in higher education as mechanical engineering course. The results obtained during the LSG sessions suggest that the game greatly increases the engagement, simulates a collaborative socialization, and transfers, at the same time, proper educational competences. These competences are related not only to rolling stock maintenance issues, but in general to the problems related to asset management. Moreover, the serious game offers a relevant opportunity to let the students apply and experience different strategies, forcing them to make mistakes, and to understand the reasons behind them during the discussion sessions. Similar to the results from Holweg & Bicheno (2002), the students expressed that their understanding of the key concepts in the process is enhanced by playing the game. When linking the design of the game to the basic needs of learning, the positive results can easily be explained. The collaboration within a team and competition between teams makes the students related to their peers, and the subject of the game relates it to the real world. The strategic performance feedback that students receive about their progress during the game make the students feel competent (or shows them they still need to practise). Concerning the autonomy of the students, in the

results it can be seen that group 1 felt free enough to take changes. The group chose not to invest and save money (taking a different strategy than group 2 and 3). Unfortunately, for that group this decision almost caused bankruptcy. Luckily it is only a game.

Further research should focus the attention on the evaluation of several serious games to use during the same master specialization. This would allow us to investigate pedagogical strengths and weaknesses of the extensive use of GBL on the learning capacity of students.

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Trends in student behavior in online courses

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Abstract

Learning management systems provide an easy and effective means of access to learning materials. Students' access to course material is logged and the amount of interaction is assumed to be a measure of student engagement within the course. In previous research, typically frequencies of student activities have been used, but this disregards any temporal information. Here, we analyze the amount of student activity over time during courses. Based on activity data over 11 online courses, we cluster students who show similar behavior over time. This results in three different groups: a large group of students who are mostly inactive; another group of students who are very active throughout the course; and a group of students who start out being active, but their activity diminishes throughout the course. These groups of students show different performance. Overall, more active students yield better results. In addition to these general trends, we identified courses in which alternative trends can be found, such as a group of students who become more active during the course. This shows that student behavior is more complex than can be identified from an individual course and more research into patterns of learning activities in multiple courses is essential.

Keywords: *Learning management systems, student engagement, temporal information, clustering, student performance*

1. Introduction

Learning management systems (LMSs) are widely used to provide course content and other learning materials online in a structured way. Students' activities within these systems are often logged. These data may be used as a source of measuring student behavior in the fields of educational data mining and learning analytics, to investigate improvements of learning and teaching. Typically, researchers analyze frequencies of activities in the LMS (e.g., Romero et al., 2013; Zacharis, 2015). However, these metrics provide no information about the timing and spread of learning activities. As students may vary in the amount of activity during the course, in this study we analyze patterns in sequences of learning activities in 11 open online courses. The sequences of learning activities are clustered to identify trends in learning behavior. Although having insight in the different trends of student behavior is already interesting, patterns in learning activities may provide a more accurate representation of learner engagement compared to aggregated frequencies of activities (Hadwin et al., 2007), and hence can be more useful for performance prediction. Therefore, we also investigate the relationship between clusters of learning behavior and student performance.

2. Background

2.1. Topics in educational data mining and learning analytics

The fields of educational data mining and learning analytics focus on the use of educational data to gain insight in learning processes and to improve learning and teaching. Several tasks can be distinguished, such as student modeling, prediction of student performance, visualization of student behavior, and social network analysis (Romero & Ventura, 2010). For these tasks, typically aggregated counts of activities in the LMS are used (e.g., Romero et al., 2013; Zacharis, 2015). In this study, we focus on information that can be derived from the sequences or the order of activities (without aggregation over time) in the LMS.

2.2. Analysis of sequences of learner activities

To identify patterns in the sequential learning behavior, sequences of activities that display similar trends over time may be clustered. Clustering sequences of learner activities has been used to identify patterns in various learning contexts, such as group work (Perera et al., 2009), mathematical exercises (Desmarais & Lemieux, 2013), educational games (Bergner et al., 2014), and discussion forums (Cobo et al., 2010). Clustering is also used in intelligent tutoring systems to determine differences in event sequences over time (Klingler et al., 2016) or to identify patterns with interesting temporal behavior (Kinnebrew et al., 2013). Most studies analyzing sequences of learner activities look at a single session per

student, instead of all sessions within a course. This is, for instance, common in web mining, as it is mostly impossible to identify users across different sessions. However, in online learning environments, users often have to login and hence can be followed across multiple sessions.

Cobo et al. (2010) clustered student activity in the discussion forum of an online course across multiple sessions. Three different activity profiles were found: inactive profiles, profiles with regular activity throughout the course, and profiles with limited amount of activities in different periods. In the current study, we also cluster sequences of activities across multiple sessions. Contrary to Cobo et al. (2010), we analyze sequences of activities in all parts of the LMS, using multiple (11) courses instead of one. Additionally, the relation between student performance and patterns of learning behavior are analyzed.

2.3. Relation between sequences of learner activities and student performance

In learning analytics and educational data mining, the analysis of learner behavior is often used to predict student performance. Studies on frequencies of learning activities in LMSs generally find that more activity typically leads to higher grades (e.g., Zacharis, 2015). However, it is also shown that the effects of frequencies of activities on student performance differ across courses (Conijn et al., 2016; Gašević et al., 2016). This might be because frequencies are not concrete measurements of theoretical concepts, such as motivation or engagement, which are established predictors of student performance.

Patterns of learner activities are argued to provide a more accurate representations of learner engagement with respect to frequencies (Hadwin et al., 2007). Hence, they can be more useful for performance prediction. Moreover, they might provide insight in the reason behind (un)successful behavior, which can be used for interventions and help. For example, Perera and colleagues (2009) identified patterns leading to (un)successful group work, which in turn could be used by the facilitators to help the students. Accordingly, we analyze the relation between student performance and patterns of learner activities in open online courses.

3. Method

3.1. Data

Data were collected from the restricted open source dataset Canvas Network Courses, Activities, and Users (Canvas Network, 2016). This dataset consists of anonymized Canvas data from open online courses taught between March 2014 and September 2015. The data consist of a main table with all page requests per user and tables describing the course items per course, such as assignments, quizzes, forum, and wiki. In total, there are 359 courses

and 464,602 cases (enrollments) in the dataset. The 302,134 unique students (students could follow multiple courses) accounted for more than 258 million page requests. There is no detailed information (e.g., age, background) available about the students.

3.2. Data pre-processing

Data pre-processing and analysis was done using R. First, all data related to activity outside the course period were removed. Ten courses which missed a course start or course completion date were removed. We selected courses with on average at least 20 page requests per user and student performance data available. Student performance was calculated by the normalized average quiz grade. For each quiz submission, the grades were linearly transformed with respect to the minimum and maximum grade obtained for that specific quiz on a range from 0 to 100. Only quizzes were included where at least 50 students finished the quiz, with a maximum grade higher than zero, and at least some variation in the grades (*S.D.* normalized grade ≥ 0.2). Based on these quizzes, the average grade per course per student was calculated. Grades were set to missing if the student did not finish a quiz in that course.

The 147 remaining courses lasted between 13 and 703 days ($M = 81$, $S.D. = 85$). To compare the sequences between the courses, a subsample of courses of similar length was chosen. The most common course length of 43 days was found in 12 courses. One additional course was removed, because all students only showed activity in 31 of the 43 days. Hence, 11 courses with 4,429 unique students ($M = 425$, $S.D. = 116$ per course) were analyzed. The courses were in the domains of Education (4x), Social Sciences (2x), Humanities (2x), Physical Sciences (1x), Professions and Applied Sciences (1x), and Computer Science (1x).

3.3. Data analysis

Clustering was used to identify patterns in the sequences of learner activities within the 11 courses. Since analyzing single page requests leads to too fine-grained information, the number of page requests per student were aggregated per day. This resulted in sequences of 43 numbers per student representing the number of page requests on each day of the course. Due to the highly-skewed distribution of the number of page requests per day ($M = 153$, $S.D. = 306$), the page requests were binned into: no activity, low activity (< 3 page requests), medium activity (3 to 100 page requests), and high activity (> 100 page requests).

The sequences are clustered for all courses combined as well as for each course separately, according to the procedure described by Gabadinho and colleagues (2011) with the R packages ‘TraMineR’ and ‘cluster’. To cluster the sequences, the differences between the sequences within each cluster need to be minimized, while the differences between the

clusters need to be maximized. The distances between the sequences are computed with pairwise optimal matching (OM). The obtained distance matrix agglomerative hierarchical clustering (AHC) is used to cluster the sequences with Levenshtein distance ('ward' in R). The obtained clusters are visualized with state distribution plots per cluster. A series of one-way ANOVAs with Tukey post-hoc tests were conducted on the normalized mean grade, to determine whether student performance differed significantly between the clusters.

4. Results

First, the clusters of the sequences of all 11 courses combined were analyzed. The sequences of activities of students were found to cluster into three different groups (see Figure 1). The first and largest cluster consists of students who barely showed activity ($n = 4,212$) and their activity diminishes even more over time. The second cluster consists of students who were highly active on most of the days during the whole course ($n = 203$). The students in the last cluster showed some activity in the beginning of the course, but the activity decreased during the course ($n = 265$). Clustering into more clusters did not result in new patterns, but merely in clusters with gradations between clusters 2 and 3.

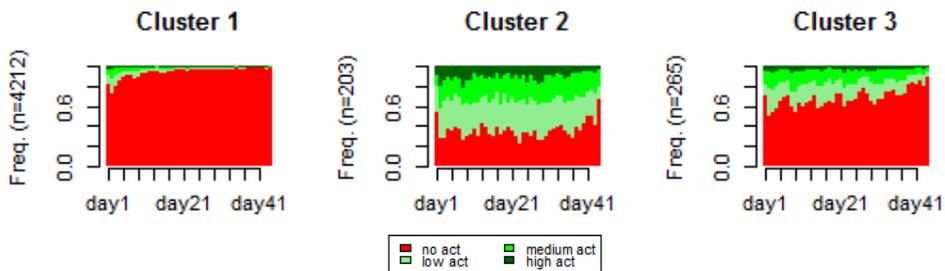


Figure 1. State distribution plots learning behavior in Canvas for all 11 courses.

A one-way ANOVA showed significant differences in student performance between the three clusters ($F(2,1977) = 164, p < .001$). As expected, students in cluster 1 received significantly lower grades ($M = 42, S.D. = 41$) than students in clusters 2 and 3. Students in cluster 2 received a higher grade ($M = 86, S.D. = 18$) compared to cluster 3 ($M = 73, S.D. = 27$). Additionally, in cluster 1 fewer students took a quiz (37%), compared to clusters 2 (94%) and 3 (92%), which indicates that these students dropped out during the course.

Second, the clusters of student behavior were analyzed for all 11 courses individually. In one course, students showed almost no activity, which resulted in less meaningful clusters. In all other courses a cluster with students who show almost no activity (similar to cluster 1 in Figure 1) and a cluster with students who show high activity during the whole course (similar to cluster 2 in Figure 1) was found. Additionally, some courses showed clusters with different patterns, such as clusters where students show high activity during the whole course, but activity drops considerably in the last two weeks of the course (3 courses). A series of one-way ANOVAs were used to determine the differences in performance

between the clusters. In 7 of the 11 courses significant differences were found in average quiz grade between the clusters. Tukey post-hoc tests were used to determine which specific clusters differed.

Two courses showed somewhat different clusters of student behavior. Four clusters were extracted in both courses (Figure 2). In the Education course (top), cluster 3 shows a different pattern compared to other courses: the students show little activity in the beginning of the course, but there is an increase of activity at the end of the course. This might indicate that these students are trying to catch up with the courses. There are no significant differences found between the clusters and student performance ($F(3,56) = 0.57$, $p = .64$). Thus, in this course there is little effect on final grade if you show no activity, mostly activity in the beginning of the course, activity in the end of the course, or activity throughout the entire course. However, this could also be due to the small sample sizes of the clusters.

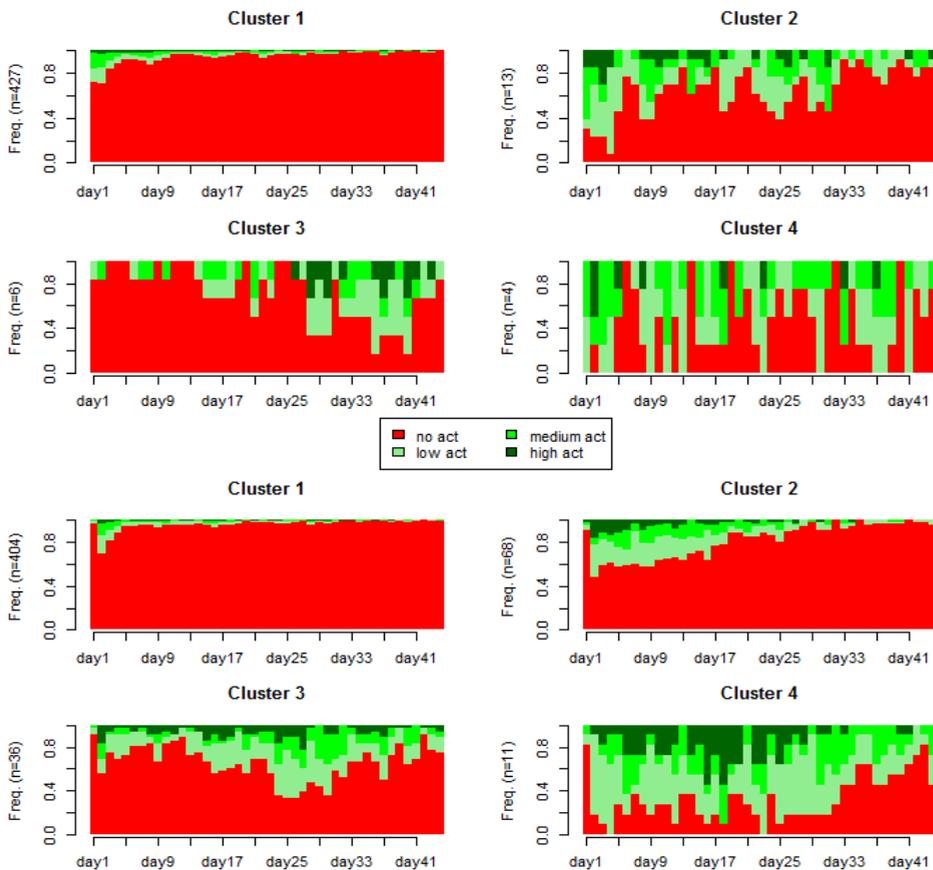


Figure 2. State distribution plots learning behavior for two Canvas courses: a) Education, b) Social Sciences.

In the Social Sciences course (bottom), cluster 3 shows a different pattern compared to other courses: the students show higher activity in the middle of the course. A significant difference is found between the clusters and student performance ($F(3,142) = 17, p < .001$). Students who show almost no activity (cluster 1; $M = 42, S.D. = 39$) have significantly lower grades than all other students. Students who show more activity in the middle of the course (cluster 3; $M = 90, S.D. = 21$) have significantly higher grades than students in cluster 2 ($M = 70, S.D. = 34$). Interestingly, no difference is found in student performance between students who show high activity during the whole course (cluster 4; $M = 88, S.D. = 16$) and those in clusters 2 and 3.

5. Discussion and Conclusion

We analyzed the patterns in sequences of learning activities and the relationship between these patterns and student performance in 11 open online courses. The results based on all courses combined showed three clusters of learning activities: students who showed almost no activity, students who showed activity mostly in the beginning of the course, and students who showed regular activity during the course. These patterns are in line with the patterns found by Cobo et al. (2010) in a course forum. However, when looking at the courses separately, more interesting patterns emerge. For instance, some courses show patterns where students are active mostly in the middle or in the last part of the course. Thus, student behavior seems to be more complex than could be identified in multiple courses combined.

The different patterns within a course and across courses can be explained by the theory of self-regulated learning. According to this theory, learning is influenced by task conditions, such as time, course design, social context, and cognitive conditions such as beliefs, motivation, and knowledge (Winne & Hadwin, 1998). Indeed, several cognitive conditions are identified to influence students' persistence in online learning (Hart, 2012), and hence might result in different activity patterns. However, no additional data is available about the students to verify this in the current context. The different patterns across courses may partly be explained by the smaller sample sizes in individual courses, but differences in task conditions could also have played a role. Lockyer et al. (2013) argued that patterns of learning activities are influenced by course design. For instance, students may show more activity in weeks with a compulsory quiz compared to weeks where no (new) course content is provided. Unfortunately, the current dataset also did not include information on course design and context. Therefore, future work should include qualitative as well as quantitative data about cognitive and task conditions to examine why the different patterns were found.

The patterns of learning activities were found related to student performance. Students who show regular activity throughout the entire course receive higher grades compared to

students who show almost no or limited activity. This corroborates with studies analyzing frequencies of activities, which generally found that more activity results in higher performance (e.g., Zacharis, 2015). Yet, these findings do not always hold when we look at individual courses. In some courses, no differences were found in performance between more active and less active clusters. This is in line with work that showed that the effect of frequencies of activities on student performance differs across courses (Conijn et al., 2016; Gašević et al., 2016).

For educational practice, the current findings imply that sequences of learning activities can provide additional insights next to frequencies of activities. This can be especially useful for improvements in learning and teaching, for example, to guide temporal course design or the design of interventions. Yet, future empirical studies are needed to verify whether the proposed improvement indeed leads to different patterns and increased student performance.

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Project Based Learning experience with engineering students for the design of steel structures

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Abstract

This work describes the Project Based Learning (PBL) experience carried out with engineering students in the field of steel structures design during the academic year 2016-2017 at the Universitat Jaume I of Castellón de la Plana (Spain). This experience is integrated in the Master of Science in Industrial Engineering.

The experience consists of simulating the activity of a technical office dedicated to the development of structural projects. A real situation comprising the design and calculation of an industrial building for a customer is presented to the students. Some geometrical aspects according to the customer desires and the industrial process to be set at the building are specified. The students are organized in groups and have to work in a project to develop a competitive solution to this real necessity within deadline.

Finally, a survey is conducted to evaluate both the impact of this experience in the learning process and the students' degree of satisfaction with respect to this technique.

The results of the survey show that PBL promotes the technical training of the students in this field and encourages the development of transversal skills, enhancing, at the same time, their motivation.

Keywords: *Project Based Learning; Engineering students; Design of structures; Structural Project.*

1. Introduction

In these days, as a result of the European Higher Education Area (EHEA) harmonization process, the necessity of new student-centered models and techniques has increased. Students not only must acquire the specific skills related to the field of knowledge of the degree but also must develop transversal skills, highly demanded and appreciated by employers and companies.

In fact, in the Bucharest Communiqué (2012), it was explicitly pointed out that nowadays graduates need to combine transversal skills and competences with up-to-date subject-specific knowledge in order to contribute to the needs of society and labor market. Therefore, these transversal skills are mainly related to continuous learning, teamwork and autonomy, critical thinking, planning and communication skills (Lacuesta et al., 2009).

Thus, the application of innovative learning techniques such as Project Based Learning (PBL) is allowing the higher education to adapt to this new scenario (Gwen, 2003). PBL is a methodology which focuses on the students who, in small groups, must carry out the development of a project to give solution to a real necessity. This methodology was successfully applied in the field of medicine at 70's to encourage unmotivated students and it became soon very popular among lecturers worldwide (Woods et al., 2000). Note that the initials PBL can be also found in the literature to refer to Problem Based Learning, a different teaching approach.

Several are the skills and capabilities that PBL allows to develop and enhance such as analysis and synthesis, research, knowledge transfer, critical thinking, individual and group responsibilities, treatment of multiple information sources, working in group, planning and organizational skills or decision making (de Miguel, 2005). During all the process, the students have to work in groups, planning their steps, distributing tasks, researching and making an analysis of all the variables involved. To successfully accomplish the activity, the student must adopt an active attitude and interact with others to contrast ideas and opinions. Actually, the basis of this method lies in thinking over the own knowledge to develop new skills and gain expertise (learning to learn).

At the present time, PBL is considered as one of the learning based methods for the new models in higher education. Comparisons made with traditional teaching methods reveal a higher level of learning when PBL is applied (Maldonado, 2008). As a consequence, the number of practical cases about the application of this technique has increased, and numerous examples can be found in literature where PBL has been integrated in technical degrees with satisfactory results. Among others, experiences with telecommunications, civil or mechanical engineering students can be found (Alcober, 2003; Rodríguez, 2015; Tejero, 2015).

Adopting the PBL technique implies the possibility to put into practice and develop several skills and competences during the learning process. The implication of students in the development of the project will help them to think about concepts than simultaneously are being discussed in theory lessons and also to review those studied in past courses. Besides, not only it is a proof of this learning the implicit knowledge acquisition but also the final tangible product developed by the students.

This paper presents a new PBL experience designed for students of the Master of Science of Industrial Engineering at the Universitat Jaume I (Castellón de la Plana, Spain). The methodology is applied in the frame of the subject “Industrial construction and architecture”. In this case, the activity consists on developing a project for the design and calculation of an industrial building. For each group of work, the tangible results of the project are a written manuscript and a poster where the structural proposal is schematically reflected. Each group exposes and defends its own solution to the rest of the class during the last session of the semester.

Next section describes the main aspects of the experience developed based on PBL which can be taken into account in the design of a similar activity. Nevertheless, since the project presented in this paper has been performed in the framework of a Master of Science of Industrial Engineering, some issues may need to be adapted when the activity is going to be implemented in another different context.

2. Activity description

The development of the activity starts with lecturers’ implication in the planning and preparation of the experience. In this case, previous to the implementation of PBL, involved lecturers had several meetings to establish the objectives, the methodology and planning the different steps of the experience. Also during its development, periodic meetings were scheduled to comment the project and discuss any arising problems which enhance the coordination.

In order to design properly a PBL learning experience, the offered project must fulfill a series of requirements such as being significant and stimulating for the students and having well-defined objectives (Lacuesta et al., 2009). Besides, a certain grade of complexity may be assured in the sense of presenting a problem with different valid solutions and likely to be typical of the professional world.

Thus, the activity here described was designed to have these characteristics. Students had to be able to propose a competitive solution for a real necessity: the design and calculation of an industrial building. A structural project had to be developed taking into account the existence of multiple valid solutions, situation likely to be faced in their future careers. In

fact, it is intended to recreate the environment of a technical office, simulating the pressure to present a competitive solution and satisfy the customer needs within a deadline.

In addition, for the sake of the good development of this learning method, it is recommended to involve a relative small number of students. Hence, the PBL methodology was implemented in a subject of a master where the number of students was small which facilitated to carry out with success the experience.

2.1. Starting point

The problem was presented and described to the students during one of the face-to-face lessons. Initial documentation was facilitated to the students by means of the virtual learning platform available at the university. The objective of the project was to design and calculate and industrial building optimizing its construction cost. The problem had some established conditions such as the location of the building and some geometrical aspects, simulating the customer's desires. The structural project includes the design and calculation of all the main structural elements as well as the foundation.

In the same lesson, the students received some notions about the methodology to follow (PBL) and the evaluation system adopted. The working groups were created during this session with the assessment of the lecturer.

Finally, the students were informed about the final product: the final project documentation and a poster which schematically, but in an attractive manner, showed the proposal. All the material had to be delivered by means of the virtual learning platform, but the poster have also to be printed to be exposed in the final session. As recommended by other authors, guidance for this purpose was given in order to assure that the material produced by the groups had the same format and a certain level of homogeneity (Lacuesta et al., 2009).

2.2. Initial analysis and research

In this methodology, where learning is acquired through thinking and experience, the research work done by the students in the field of study is crucial. Students, both in an autonomous or in group form, must examine with detail the proposed problem and analyze the scenario. The base knowledge of students it is very important at this stage and it will be improved through the development of the project, with self-study and with the assessment of the lecturers. Literature review was encouraged at this point to extend the knowledge and references on this field.

2.3. Lecturer role

In this student-centered learning methodology, lecturers assumed a secondary role in the sense that they became the engine of all the process that allows the students to develop the project; became observers and guides of the student learning process. Lecturers were information providers when the groups required it and supervised the continuous work of the students promoting always the critical thinking and the deliberation about the tasks done. Besides, during all the process, lecturers were aware of the learning process of the students, both individually and in group, as a part of the evaluation process.

2.4. Interaction with the students and evaluation

During the activity development, the different working groups met periodically to develop the project. Besides, tutorial sessions and a final session for the exhibition of the different proposals took place.

- a. Working sessions: Working teams met to develop the project according to the scheduled tasks. As mentioned before, lecturers will check the progress of each group, answer questions and guide the students in the resolution of their doubts.

It is important to note that for the correct development of the activity and in order to facilitate the teamwork outside the university facilities, an educational license for software specialized in the design of steel structures was provided, so as the students could work on their project following their own schedules.

- b. Tutorials: In these meetings, lecturers conversed with the students in order to examine the condition and quality of the work done by far.

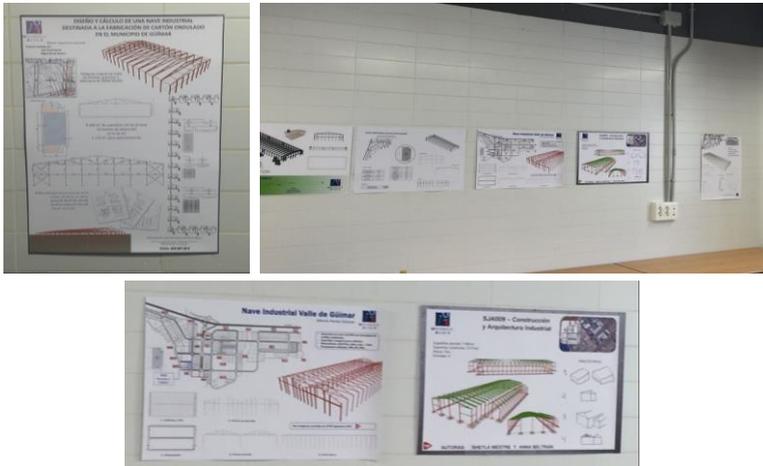


Figure 1. Exposition of posters with the different proposals.

- c. Group exhibitions: Each group presented its work to the rest of the students during the final session of the subject. The different proposals were exhibited by means of the posters produced (Figure 1). The session was organized trying to simulate the environment of a conference poster session. Each team explained the details of their proposal and after that, both lecturers and students, questioned them about it.

2.5. Final assessment

Since PBL is a methodology focused on the student, the evaluation process becomes especially relevant. Given the nature of the technique, the evaluation must be carried out both individually and on a group context. In this case, the evaluation consisted of:

- a. Project assessment: for this subject, this mark is the 50% of the student's final mark (35% final project, 15% oral defense) and is established by all the lecturers.
- b. Individual evaluation: in this case, it corresponds to the 50% of the student's final mark. It covers mainly the individual student's learning and effort. Lecturers had done an individual monitoring of the student during the whole process and the registered information served to establish this mark.

3. Results and discussion

The analysis of this learning experience was performed thanks to the continuous assessment and the surveys carried out at the end of the activity. Some general aspects about the utility of the PBL as a learning technique were checked by means of a Yes/No section (Section A) of the survey. The aspects valuated were:

- A1. Adequacy of the subject embracing the project.
- A2. Necessity of technical concepts to develop the project.
- A3. The project complements the technical concepts treated in classroom lessons.
- A4. Proper duration of the project.
- A5. Adequacy of available material and resources.

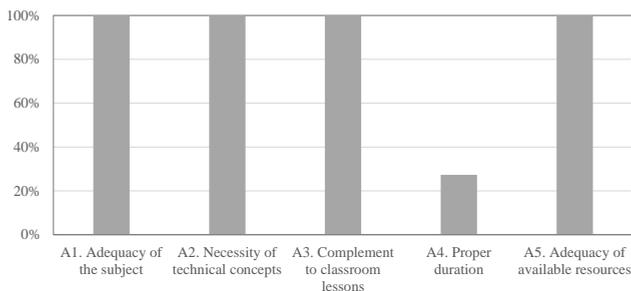


Figure 2. Student assessment of the utility of the PBL methodology.

As shown in Figure 2, all the students considered that the subject was adequate to apply this methodology and were satisfied with the resources available. In addition, the students affirmed that technical concepts were essential to develop the project and so it served to complement the classrooms lessons and apply these concepts. However, only the 27% of the students considered that the deadline established was enough to develop properly the project. It is clear that adopting new techniques implies a change in their learning style and this adaptation takes time. Therefore, in order to control the time and effort that students invest in the project, lecturers should have paid more attention in that sense. For next experiences, some measures could be taken, such as for example limit the final report extension.

On the other hand, another section (Section B) valued from 1 (lowest level) to 5 (highest level) tried to check the grade of achievement of the competences involved: continuous learning of technical knowledge (B1), autonomy (B2), teamwork (B3), communication (B4) and planning (B5) skills. Besides, this section included three more items:

- B6. Level of motivation in the development of the project.
- B7. Level of satisfaction with lecturer’s attention.
- B8. How much do you recommend this type of experiences for other subjects?

In Table 1 and Figure 3, the qualifications given by the students are displayed. Whereas the students marked as satisfying (between 3 and 5) the level achieved in their capacity of learning to learn, autonomous work and planning skills, they considered that their aptitude of working in teams and communicate were not enhanced by this methodology. This fact points out the difficulty of developing these skills and the reason why they are highly appreciated by employers.

Table 1. Questions about the PBL methodology and level of achievement of skills.

Question	Mean	Question	Mean	Question	Mean	Question	Mean
B1	4.18 ±0.60	B3	2.89 ±1.62	B5	3.56 ±1.17	B7	4.89 ±0.30
B2	3.78 ±0.89	B4	2.56 ±1.48	B6	3.56 ±1.25	B8	3.89 ±1.14

However, answers to the last three items (B6, B7 and B8) show the high level of satisfaction of the students with the activity and with the lecturers attitude so as, in general, they recommend to apply the PBL methodology in other subjects.

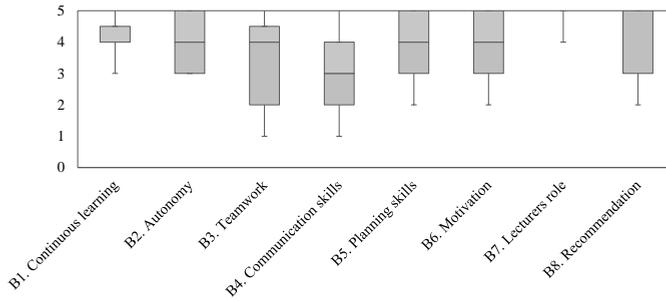


Figure 3. Results from questions about PBL methodology (see Table 1).

4. Conclusions

In conclusion, and although from the point of view of the lecturers, the implementation of this PBL experience involved much more effort than traditional learning, it can be said that both lecturers and students were highly motivated during its development and that great interest was observed in the students when this innovative activity was proposed. In fact, they recommended its implementation in other subjects.

Considering all, lecturers have planned to not only repeat this experience with master students next semester but also apply it to other subjects with undergraduate students in order to vary the student's profile to which the experience is addressed and improve the implementation of PBL methodology.

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Improving the acquisition of English language competencies with international workgroups of university finance students

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Abstract

This paper discusses a teaching innovation project that integrates technological communication advances with the small group methodology to improve the English competency of university students of finance. This is a fundamental competency for studies in finance considering the increasingly international framework of financial business and the increasingly required mobility of human resources in all types of financial careers. This methodology requires the cooperation of a foreign university to help students understand the practical implications of using English when applying the theoretical concepts and methodologies studied in class in an international professional setting. As a first approach, we implement and assess the implementation of this methodology and its impact on students' learning process in an elective module offered in an official degree in finance in Spain.

Keywords: *International small working groups; linguistic competences; finance; university learning.*

1. Introduction

Finance is increasingly conducted in a global environment, in terms of not only financial markets but also corporate finance. It is therefore essential that graduates in finance have an international orientation and acquire the knowledge and skills to operate effectively within their financial careers. This means, among other things, that graduates are required to know the international language or *lingua franca* used by financial professionals— independently of their origin and country—which is English.

The Spanish National Institute of Education Assessment (2012) recognizes that nowadays appropriate training in languages, such as English, is essential for students that will face a global labor market requiring communication in contexts such as commercial, industry, tourism, and international relations. In financial careers, the new global environment indicates an increasing need for financial managers to collaborate in international expansion projects. This may be within a multinational firm or within a national one in the process of expanding its market through different agreements and contracts with foreign customers, or expanding its range of suppliers to an international extent. The globalization of financial markets compels financial advisors and personal financial consultants to use English as a professional language. In fact, they use English terms even when talking about professional matters in their mother tongue. Furthermore, the supranational standards and regulation of the banking and insurance industries (i.e., capital standards, solvency, financial stability), as well as the international integration of financial services firms, emphasize the need for training in English not only for professionals such as traders, dealers, or banking and insurance managers but also for the required higher number of experts in finance across all type of public and private international economic and financial governmental and non-governmental institutions and organizations.

The significant challenges faced when working in international environments are not only concerned with communicating through a different language itself, or with the well-known problem of managing to conduct business with people from affiliated or third party firms with differing cultures. Additionally, as Sheppard et al. (2003) stated, some difficulties are caused by working through “virtual teams,” which comprise physically separated individuals or groups that are connected by various information and communication technology tools.

In this paper, we explore how some contributions made by research or academic works in the distant areas of applied linguistics (learning of foreign languages, specifically), teaching methodology (small group learning), and information and communications technology (ICT) (e.g., groupware as defined by Whatley, 2006) can be used for the better acquisition of English language competency in the area of finance for university students. In the following paragraphs, we discuss how advances in these areas can be used to implement an

effective program in which students from different universities and countries collaborate to work in groups.

This work is organized as follows. After the introduction, we discuss the selected methodology to effectively improve the acquisition of the financial English competence, that is, the international teamwork, for which the use of ICT is required. The third section explains our research project. Finally, we highlight the main conclusions of the work along with the limitations.

2. Theoretical Framework

The conceptual foundation for this innovation project relies on previous developments in three main areas of knowledge: the improvement of English competence for non-native English speakers, the usefulness of small working groups as a learning methodology, and the uses of ICT and related knowledge within the education context. Thus, the learning process is modified to include a complex new methodology to reduce or eliminate some deficiencies previously detected in students' acquisition of financial English competency, such as those related to the effective use of a foreign language in a professional international context.

2.1. English competence

The European Qualifications Framework (EQF), developed within the "Education and Training 2010" work program of the European Commission, includes communication in a foreign language among the key competences for lifelong learning, in addition to others such as basic competences in science and technology, digital competence, learning to learn, interpersonal and civic competences, and cultural expression (Martyniuk, 2006). It is a common European framework to be taken as a reference for the key competences for communication in a foreign language. The EQF mentions the following descriptors.

- "Knowledge of vocabulary and functional grammar and an awareness of the main types of verbal interaction and registers of language; of societal conventions, and the cultural aspect and variability of languages;
- Skills to understand spoken messages, to initiate, sustain and conclude conversations and to read and understand texts appropriate to the individual's needs; to be able to use aids appropriately, and learn languages also informally as part of lifelong learning;

- A positive attitude involving the appreciation of cultural differences and diversity, and an interest and curiosity in languages and intercultural communication.”

Barner-Rasmussen et al. (2014) specify that language skills can refer to the language of a subunit in a country, such as a corporate language, a professional or functional language, a regional *lingua franca*, and/or “company speak.” For example, the language skills under study in our case are those of the professional financial English concerned with business valuation.

2.2. English in students’ financial career

As mentioned previously, in today’s global financial business realities, financial professionals have to face and overcome some language boundaries. Barner-Rasmussen et al. (2014) gather a list of advantages from the literature for professionals with relevant language skills. They tend to become “language nodes” with better-than-average access to information. This enables them to act as “language mediators,” “bridge builders,” or “bridge individuals,” taking on a range of intermediary roles (e.g., as gatekeepers, liaisons, translators, and intermediaries for colleagues with more limited language skills). In turn, these roles help them build networks and formal or informal positions of power. Consequently, English skills turn out to be a strategic part of future financial professionals’ training. This is a powerful reason to motivate to learn as well as to pay attention to the learning dynamics of the English language (Spanish National Institute of Education Assessment, 2012) in schools and universities.

2.3. The role of ICT to facilitate international learning-teaching experiences in university

ICT has opened a universe of possibilities within the learning-teaching environment. When communication and groupware possibilities are included as teaching-learning supporting tools in combination with new techniques, such as learning-by-doing and case studies, students can acquire relevant skills and competencies (Whatley, 2006; González and Jimenez, 2014). Furthermore, the internet contributes to removing time and space barriers and allows students to move with more flexibility through cyberspace (Gonzalez, Gallardo, and Jimenez, 2014). An interesting derivation of this possibility is that students can attend classes at distant universities as online participants when virtual learning is implemented in that specific university. A more interesting possibility for our purpose is that professors and students can collaborate on common teaching-learning experiences from different universities, located even in distant countries. An increasing variety of tools is available to

be used, such as platforms to share or exchange information and to work in groups with simultaneous access, chats, wikis, social networks, e-mails, and WhatsApp.

The University of Leon is involved in a strategic plan to internationalize professors, students, and degrees, by promoting diverse initiatives to raise the level of professors' and students' foreign languages. Our project is developed within this framework, as the main goal is improving the financial English competency of the students of an elective module included in an official degree. The possibility of working with foreign students (enrolled in a different university) collaborating on a common project but taking part in their own module in their own institution, and with their own professor codirecting the project, offers a number of advantages. The international content of the project, necessary to take advantage of the knowledge of the two (or more) countries involved, enhances the international elements of the module (and the degree) program. Additionally, this is an experience of internationalization for local students and professors, who may not have the opportunity to go abroad. The practice of English as the only possible language for communication may be seen as an advantage by most participants in that it may provide motivation for improving English competency, while it may be seen as a disadvantage by a lower group of low-level English speakers.

2.4. The use of international working groups

Learning in small groups is the most appropriate way to expose students to a comprehensive language learning experience. In fact, small group work has been increasingly used to developing students' communicative competence in English as a foreign language (Fushino, 2010). The reasons are that in small groups students interact with each other in natural ways (informal contexts), which is likely to develop their communicative competence in English (Fushino, 2010), but they also have to negotiate meanings, use technical terms, present ideas, and persuade (Jacques, 1991). Furthermore, the impossibility of communicating in their mother tongue with a part of the group takes the students into a linguistic immersion experience in a real-life academic activity. That immersion produces significantly higher performance in communication skills for these students than for those other students not involved in the same way in these types of activities (Spanish National Institute of Education Assessment, 2012).

However, this teaching-learning methodology does not lack some disadvantages. Students may work actively in groups, and their participation (willingness to communicate) will be conditioned by nonlinguistic and noncognitive contextual factors such as classroom layout, students' interpretation of their tasks, and peer relationships (Fushino, 2010). When a second language is used, the limitations of the small group learning methodology concerning communication are exacerbated. Thus, freeloading, distraction from the task,

and vocal dominance by a minority or just one person (Gunn, 2007) may hinder the learning process. Additionally, an international group includes different cultures, and the effect of these differences is stressed in distance learning (Gunn, 2007). Thus, social interaction to get a sense of the community of learning is undoubtedly more difficult in computer-supported collaborative learning settings than in face-to-face settings (Kreijns, Kirschner, and Jochems, 2003).

Fushino (2010) finds evidence that active interaction between students depends on the students' balance between communication confidence and communication apprehension. Some advisable actions to reduce apprehension are: providing teambuilding activities with which group members can develop bonds, facilitating a supportive atmosphere, and avoiding teaching and peers' critical attitudes. Other actions are recommended to help students gain communication confidence. For example, assigning success-oriented, doable tasks with clear instructions, demonstrations, and easy-to-follow steps (Jacobs, 2007).

3. Research Project

Our project uses a case study methodology where the students are placed into international working groups, in a virtual learning environment.

3.1. Description of the research design

We formed small groups made up of four members (occasionally five, when the total number of students was not enough to form a new group): two Spanish members, and two Belgian ones. Considering that the English level of the Spanish students was heterogeneous, and poor in some cases, every group was formed with at least one student with a minimum level of English. The supportive intention was highlighted to reduce communication apprehension in regard to contact with the foreign members of the group. Thus, apart from the innovative international feature, the education method can be defined as tutor-oriented small group learning, considering the organization of the work (Gunn, 2007), but also as problem-based learning, if we focus on the nature of the tasks realized.

During the second semester of 2014–15, we implemented a case methodology to be performed by international small groups to improve the English teaching-learning experience within the Financial Firms Valuation module of the Finance Degree at the University of León. This is an elective course, in which the students obtain a deeper knowledge and higher level of practical application in business valuation after they have studied a previous mandatory module on the subject. This is a proper module to be taught partly in English, as the Spanish students acquired basic knowledge on concepts and

methodologies in the previous mandatory module during the first semester. Therefore, they are in a good condition to conduct an initial review of these concepts and methodologies in English at the beginning of the second semester. Thus, we planned to teach theoretical sessions in English, practical ones in Spanish, and tutorial practical ones in English (Spanish on demand).

To motivate students to use English during the practical part of the module, we decided to form international work groups in which some of the students were not Spanish speakers. They need not be native English speakers to provide both parts of each group with the same incentive to improve their foreign language skills to communicate with others. In the case of our students, the degree program is almost completely taught in Spanish, except for two elective modules of English and the elective module on business valuation, which is half taught in English. The students' level of English is heterogeneous, and sometimes poor, especially their listening skills, in line with the English level of Spanish students, as indicated by international level tests (European Commission, 2012; National Institute of Education Assessment, 2012). To cope with this drawback, we included at least one student with higher-level language proficiency from each country to facilitate communication with the part of the group from the other country.

E-learning devices are necessary for communication (a platform, social networks, etc.). Written communication favors the understanding of Spanish students, because listening-speaking skills are not necessary. The resolution of case studies by groups fosters teamwork and communication skills in English between both parts of the group from different nationalities.

An e-learning environment is necessary to integrate students and professors from both universities into the same activity. From the initial contact between the professors to decide to collaborate, lots of information has to be exchanged until the final assessment of the activity, and all messages and documents sent from a member of one university to a member of the other must be in English, forcing all the participants to develop linguistic competences. Thus, for the students, it is necessary to read academic English texts, follow the lectures' explanations on the theoretical and practical aspects of the work, think about the content of the written work to be performed, write messages to the other part of the group and read the ones received from them, write the part of the written essay decided by agreement, and critically review the work written by the other members to properly integrate every part in teamwork. For the professors, it is necessary to establish contact and decide the content and conditions of collaboration to fulfill the module requirements for each university. It is likely that the modules have remarkable differences in content, objectives, competencies to be obtained, and ways of assessment, as well as schedule, vacation periods, and beginning and ending dates. Additionally, the professors have to prepare the texts of the case study and the material to explain the theoretical concepts and

practical methodologies to be used (excel pages, real case practical examples, etc.). During all these required communication activities, both formal academic and colloquial/informal English must be used by students and professors.

Therefore, the case study activity is going to be used to attain two different groups of competences: (1) those related to the acquisition of knowledge (theoretical concepts and practical methodologies) and its use to solve real-data problems in finance, and (2) those related to the use of English in a professional teamwork scenario.

The case study concerns the financial aspects of the international expansion of a firm. Material is provided to the students, and each lecturer conducts a lesson (through video conference to the students in the other country). During tutorial hours, the professors help students understand the case and obtain information from the internet to solve the case and develop the computing and written solution of the case. The students are given some questions, some deadlines to finish relevant parts of the work, and a final deadline to deliver the whole solution of the case.

The written material with the case is provided to the students through the university virtual platform (for example, Moodle). The members of the groups can examine a part of or the whole information as many times as they need to develop the quantitative proposal of the group and to write the essay to answer the questions. Several partial deadlines are established for students to send specific portions of the work to the part of the group in the other country. During the tutorial practical sessions in the computer room, the professors help the students with theoretical, methodological, and linguistic doubts before sending the required portions of the work to the part of the group in the other country. The material elaborated by each part of the group (they have parallel assignments) must be reviewed by the other part to make suggestions to improve it and also to integrate all the parts as a unique homogeneous written work. This way, the students will have the opportunity to value the partial solution given by the other half of the group and to decide whether their own answers fit with it and have a similar level of quality academically as well as grammatically. Finally, both the excel page and written essay are sent via the virtual platform to the corresponding professor for assessment. Further, the students are required to keep an individual diary of the whole practice to serve as an indication of their participation and as a way for every student to express his/her opinion and assessment on the development of the teamwork. The professor can assess the individual implications and individual level of English of each student.

Phase 1: Establish an agreement with a professor in the same field of knowledge with similar didactic interests in a foreign university. As the first approach, English should be the second language in both universities. None of the students should be a native English speaker.

Phase 2: Preparation of the case study material.

Phase 3: Agreement on the agenda and conditions of participation for lecturers and students.

Phase 4: Formation of international small groups and interconnection through ICT tools.

Phase 5: Working in groups with tutorial assistance from the professor/lecturer.

Phase 6: Assessment of the students' academic and linguistic competencies in both the group essay on the practical case and the individual diary on the practice.

3.2. Students' perception of changes in their English competency

To evaluate the students' perceptions on the implementation of the methodology, we included several multiple-choice questions in a questionnaire posed at the end of the semester. Most of the questions allow only one answer to be chosen, and a few are flexible to allow more than one answer to be chosen. The questionnaire was distributed through the virtual platform of the university, thus avoiding transcribing errors. The number of students following the course was 17 from each university, but these questions were posed only to Spanish students, which are the group under study in our project.

Table 1. Questionnaire (only questions referring to the project are included)

1.- Has it been difficult to follow the classes in English?	a) Quite a lot b) No, or Hardly c) It became less difficult as the course advanced	35% 47% 18%
2.- Have the theoretical classes in English (with written documents in English) helped you to improve your knowledge of technical vocabulary?	a) Quite a lot b) No, or Hardly c) Do not know/No comment	65% 29% 6%
3.- Have the theoretical classes in English (with written documents in English) helped you to improve your skills in reading, writing and speaking in English on the module contents?	a) Quite a lot b) No, or Hardly c) Do not know/No comment	65% 29% 6%
4.- What was your experience of collaboration with a foreign university and of taking part in an international group like?	a) I liked it as a new experience; I have seen different ways of working and viewpoints b) I did not like it. Organizing the work was difficult because of the different focus c) It forced me to use English in practice and that made me improve d) It forced me to use English in practice and that was difficult and stressful	47% 35% 45% 12%
5.- Should this type of practice be maintained as a part of the module?	a) Yes b) No c) Do not know/No comment	76% 6% 18%

Looking at the percentage of answers in Table 1, we can see the poor heterogeneous English level of the students (35%) and their difficulties with following classes (though the main professor was not an English native speaker, but a Spanish one with a C1 level). The first positive result is the perceived improvement in the ability to follow classes by 18% as the course advanced. The same proportion of students (65%) felt an improvement in both technical vocabulary and communication skills (reading, writing, and speaking). Concerning the integration in international small groups, the same proportion of students with difficulties in following the classes (35%) found the organization of work difficult because of the different focuses. Nevertheless, only 12% of them believe that being forced to use English in practice was difficult and stressful while 45% of students think that being forced to use English in practice made them improve. Finally, 76% of participants think that this type of practice should be maintained, which we interpret as a positive global perception.

4. Conclusions, Limitations and Further Research

We have implemented an innovative methodology to help students improve their financial English competency: international small working groups. The proposed methodology benefits from some advantages for foreign language learning using small working groups, which can be summed up as interaction among students to communicate technical knowledge in an informal context. The international origin of the group members forces linguistic immersion in a real-life academic activity, which allows 45% of students to improve.

At the same time, the use of small groups has some limitations, as students cannot be forced to participate at a specific expected high level of communication. This limitation is exacerbated by talking in English and by the use of ICT communication tools instead of face-to-face communication. To cope with these limitations, we have been cautious in ensuring that at least one of each group of participants has a minimum level of English and that every international session is tutored by two professors jointly to resolve any possible doubts faster or avoid any communication pitfall. Considering the lower level of Spanish students in listening and talking skills, written communication through ICT tools turned to be an advantage, in contrast to the listening-speaking alternative of face-to-face communication. By contrast, differences in teaching focus, learning culture, degree programs, holidays, and festivities by country turned to be the most salient obstacles to the success of the practical application of the methodology.

This study is the first approach to the use of this kind of teaching-learning methodology. Therefore, despite the promising perceived improvements in the financial English competencies of the students, the difficulties with coordinating a practice point to the need to pay attention to the temporal coordination of the module contents by considering calendar differences. This type of practice is time consuming for professors and cannot be implemented in big groups, but it would be interesting to apply the practice to a group of students large enough to differentiate results by different levels of English.

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Effective Integration of Gamification and Learning Management Systems for Creating Gamified Learning Arrangements

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Abstract

This paper describes ongoing research concerning the effective development of gamified learning arrangements. It shows the necessity for more standardization of the design of such arrangements and reveals potential ways in order to support this need with the use of a domain-specific modeling language. The latter is used by lecturers for designing and exchanging models of gamified learning arrangements and provides the possibility to automatically generate a working learning management system using a language specific generator. The generated learning management system can directly be used by learners and furthermore allows to track the individual learning process for both learners and lecturers.

Keywords: *Gamification; Domain-Specific Modeling; Learning Management System; Learning.*

1. Introduction

The use of game design elements in learning contexts has gained high popularity recently. According to Deterding et al. (2011), the hype about gamification started in the second half of 2010 when the term was coined and has “institutionalized itself as the common household term” (p. 9). Deterding et al. (2011) provide a widely accepted definition for the concept and describe gamification as “the use of game design elements in non-game contexts” (p. 10). Since the creators of this definition characterize it to be on a generic level, the following definition for gamification in learning contexts is suggested for this contribution: “Gamification in learning contexts is described as a concept which integrates game design elements and processes into learning activities in order to increase learning motivation and thereby changes the behavior of learners” (Bartel & Hagel, 2016, p. 6).

Several researchers (Deterding et al., 2013; Dicheva & Dichev, 2016; Nah et al., 2014; Rughinis, 2013) argue that there is little research on how to

- systematically enrich learning activities with elements of gamification,
- bring them effectively into practice and
- be able to evaluate their impact on learning.

Meanwhile, some systematic approaches exist (e.g. Danelli, 2015; Deterding, 2015; Kapp, 2014; Marache-Francisco & Brangier, 2013; Morschheuser et al., 2017), but most of them operate on a fairly high level, or even on a meta level, and do not describe their operationalization in terms of how learning material would actually be transformed when following these design processes and how it could exactly be enriched with game design elements (Rughinis, 2013). Moreover, these approaches remain theoretical. Furthermore, the number of current design approaches for creating gamified learning arrangements shows that this research field still seeks more standardization (Deterding et al., 2013). An increase in standardization, like IEEE LOM (IEEE, 2009), would contribute to the comparability of gamified learning arrangements and increases the possibility for evaluations that would actually allow new insights on the impact that gamification has on learning.

An initial way to address this problem is to develop design approaches that do not end with applying gamified design processes on learning materials or vice versa, but which aim to integrate further, for example, by supporting the structured and effective implementation in learning management systems. That would bridge the gap between the theory of gamified learning arrangements (including their learning contents) and the implementation in educational software. This software could directly rely on a gamification design framework (e.g. Werbach & Hunter, 2015) and furthermore would be able to represent common learning concepts like certain types of learning tasks. According to Dicheva & Dichev (2016) this kind of software is still missing in the prevailing scenery of gamified learning

platforms. They see a necessity for "... a new type of educational software that can support intelligent mentoring of gamified flipped learning formal classes or informal groups of learners" (Dicheva & Dichev, 2016, p. 5) and characterize it as being "... easy-to-use tools for automatic generation, checking, and personalized delivery of abundance of practice exercises" (Dicheva & Dichev, 2016, p. 6).

1.1 Goals

In order to tackle this issue, our vision is to overcome this gap between theoretical gamified learning concepts and their practical implementation in the context of a learning management system. To do so, relevant concepts of gamification (e.g. game design elements) for learning purposes had to be identified first. In a second step, their inner structure and interdependencies with other gamification and learning concepts have to be analysed. Third, a technique for systemizing these findings was needed in order to provide a tool which allows the effective implementation of this systemization. Therefore, the following research questions were formulated:

RQ1: Which elements of gamification have recently been applied in higher education learning contexts?

RQ2: How can these gamification elements be described according to their inner structure, interdependencies with further elements and rules they follow?

RQ3: How can the findings of RQ1 and RQ2 be organized and which technique seems suitable for this task?

RQ4: How could a software prototype reflect this organization and allow lecturers to effectively create gamified learning arrangements within a learning management system which can be directly used by learners?

While RQ1-RQ3 have already been discussed and answered in previous work (Bartel & Hagel, 2016a; Bartel & Hagel, 2016b; Bartel, Hagel & Wolff, 2017), this contribution focuses on answering RQ4.

1.2. Related Work

Currently, to our best knowledge and after extensively searching the literature there is no comparable approach for the educational field existent.

In the enterprise sector, Herzig, Ameling & Schill (2012) present an extension for SAP SE which can be used for creating and implementing gamified business-to-consumer (B2C) scenarios with a textual domain-specific language. Hence, the underlying systematization of gamification concepts is expressed using a textual domain-specific language (DSL) that is used for generating code in the SAP SE environment (Herzig et al., 2015).

Besides this, Yohannis (2016) presents a concept and early results for using a graphical domain-specific language in order to generate a game which supports the learning of software modeling. Since Yohannis' work is still in its early stages, it cannot be determined to what extent software modeling topics are covered through his work and which learning arrangements are supported in particular. Furthermore it is not clear how these modeling games shall be designed by facilitators and how the *Lense of Intrinsic Skill Atoms* (Deterding, 2015) is actually contributing.

1.3. Structure

The rest of the paper is structured into 3 sections. The next section describes the methodological foundations for the research and the results that were gained so far. Section 3 details the implementation and shows off characteristics of the software. The last section summarizes the findings and gives an outlook on future work.

2. Developing an Executable Domain-Specific Modeling Language

2.1. Research Design

Since the output of this research is at least one artefact, we follow the Design Science Research (DSR) model of research (Hevner et al., 2004). DSR covers two complementary paradigms, behavioral science as well as design science (Hevner et al., 2004, p. 76f.) and relies upon requirements derived from real world problems (human beings, organizations and technology) as well as the proper application of science (foundations and methodologies). Due to the fact that Hevner et al. (2004) do not determine sub-methods for each activity when making use of DSR, we may apply context-specific methods that are adequate for creating and validating a new increment of an artefact. These sub-methods are briefly described in the following.

2.2. A Brief Summary Regarding the Results of RQ1-RQ3

For answering RQ1 we have conducted a literature review using a qualitative approach according to Mayring's document analysis method (2015). In total, $n=32$ papers were chosen for evaluation out of a total sample of $N=3656$. We identified a large number of game design elements but reduced them to the following components by abstracting differences and, based on further literature reviews that tried to answer RQ1, and besides focusing on the most widespread: *Badges, Points, Levels, Skills* and *Unlocks*. For them, a platform analysis of 11 gamified learning platforms was conducted (RQ2) in order to extract their inner structure (Bartel, Hagel & Wolff, 2017). The results were documented in domain models. Considering both, the domain models as well as the insights of the literature review, we were able to abstract these concepts and create (RQ3) a graphical domain-specific modeling language (DSML) following the domain-specific modeling

(DSM) approach by Kelly & Tolvanen (2008). The parts of the DSML that a facilitator can use for modeling gamified learning arrangements are shown in figure 1. The DSML is based on the Gamified Course Design Process (GCDP) which is a structured method for creating gamifying learning arrangements and uses the same concepts as the DSML (Bartel & Hagel, 2016b). The GCDP serves as supportive means before the actual gamified learning arrangement is designed with the DSML which allows to systematically create gamified learning arrangements on a theoretical level.

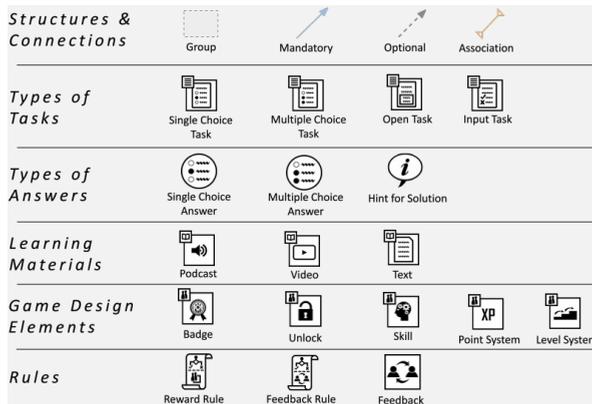


Figure 1. Graphical Notation for the DSML

3. Implementation

Figure 2 shows the DSML in action. This modeling example illustrates a single choice task with three answers and one feedback rule. Rules in general consist of a user action that has to be performed to trigger the rule, one or more constraints that have to be fulfilled to be executed further and accordingly one or more consequences that are executed when all constraints are fulfilled. In this case a feedback rule is attached to the single choice task, meaning that the user is notified with the feedback object of Feedback_13614 when some defined user action is detected on the single choice task. The same procedure can be applied for reward rules, while a reward is considered to be one or more game design elements.

For defining the required information for each graphical element, for example, the question text in a particular task or the user action for triggering a rule, each element provides further input dialogues which can be opened by double-clicking on the element. In this way game mechanics like collecting items or competition (Werbach & Hunter, 2014) can be implemented just by using rules and structuring the processing procedure of the tasks with the relations. Tasks and learning materials can be connected in two different ways, assuming that A stands for one task or learning material object and B for another:

1. Mandatory ($A \rightarrow B$): B is only unlocked for the learner if A is completed.
2. Optional ($A \rightarrow B$): The completion of A is not necessary for working on B, but recommended.

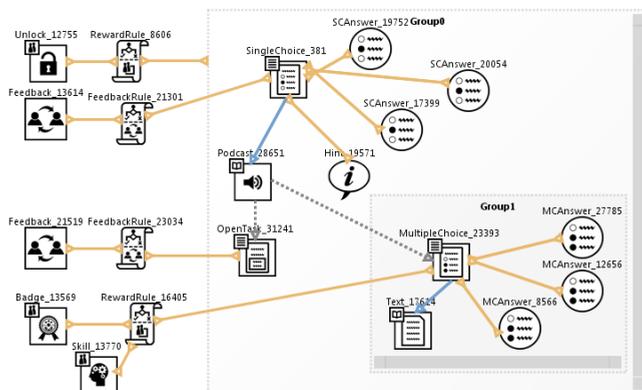


Figure 2. The DSML in Action

Hence, in our example, only when the single choice task is completed, the learner can listen to a podcast. After that, a learner can decide whether to continue with the open task or the multiple choice task. Thus, the concept of learning paths is also provided. For creating more complex reward or feedback rules, tasks or learning materials can be clustered in groups. Groups also allow the attachment of rules. Therefore it is for example possible to define a rule for a group, which is triggered on every completion of task within that group that checks if all single choice tasks are answered correctly and in time and if so rewards learners with a badge and a certain amount of a user-defined point currency.

Once a facilitator has completed the model of the gamified learning arrangement, one is able to automatically generate a learning management system out of the model, which learners can use for actually working on materials or tasks, meaning that a facilitator does not need to write any source code. Due to the way the DSML is constructed, one is easily able to extend the DSML, for example, by adding a new type of rule or game design element. That allows a high degree of flexibility for lecturers and does not force existing gamified learning arrangements to be implemented in learning management systems, where they do not fit and therefore require a lot of compromises which can reduce their quality. Furthermore the models of the designed gamified learning arrangements are exchangeable between system environments, since the underlying technology is decoupled from the contents of the model.

4. Conclusion and Future Work

The implementation of the learning management system is still ongoing and not finished yet. It is also planned to integrate an analytics component for lecturers, which tracks the individual learning progress of learners and provides extension possibilities for approaches out of the adaptive learning theory.

As soon as the prototype is completed, it is planned to evaluate it from both sides, the design view focusing on lecturers, and the learning view while learners are focused. It is assumed that the results of the evaluation will confirm our point of view on the entire concept and thus adds value to the research community in this research field.

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Project studies integrated into the working processes of companies

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Abstract

In this paper, the concept of the project studies within the in-service master's programme "Professional IT-Business" is presented. The concept comprises several elements that enable and support learning in real working environments. Project and working-process-oriented teaching and learning formats that have been developed to strengthen the skills of the students are described. These teaching formats are applied in cooperation between third-level institutions and companies.

Keywords: project studies; in-service; reference process, didactic concept

1. Introduction

Project-oriented teaching and learning programmes (project studies) facilitate the development of the professional skills of the students. As a result, project studies are part of the curriculum in many different study programmes. Project studies are often executed within companies or in strong cooperation with companies (cf. Jung 2009, Kleuker & Thiesing 2011). The students experience real working environments and work in and control real projects. They have the opportunity to apply their knowledge and gain practical experience. The learning is thus shifted from an academic focus to real-world practical work and is more driven by professional demands. Learning within the work process places the emphasis on self-organisation and self-learning (Kruse 2009, Liebehenschel 2013).

Although several benefits motivate the use of project studies, the organisers of project studies meet different challenges that have to be overcome:

- How can project studies and learning be connected?
- How can it be proven that the learning targets have been met within the project?
- How can it be ensured that skills have been improved?
- How can the learning targets, tasks and skills that have to be achieved within the project be described, even though the individual projects might be totally different, e.g., with respect to the technology employed?
- How can the students be supported although they work in different projects with different companies?

In order to specifically support the occupational competence of students, an innovative concept for project studies courses was developed at the HTW Berlin within the framework of the in-service master's degree programme "Professional IT-Business". In the project study, students learn as part of the work process in real-world projects (practical projects) in (their own) companies. The students organise the learning-at-work themselves but receive extensive personal and technical support. A process-oriented curriculum, the so-called reference project, provides the structure of the project study. It serves as a model for the selection of the practical project, the planning of the working and learning processes, and also the proof of the successful completion of the project study. All processes of the reference project must be verifiably mastered by dealing with them, reflecting on them, and documenting them. In this article, the essential building blocks of this concept are presented.

This article is structured as follows: following a short introduction to the in-service master's programme "Professional IT-Business" and the "Project study" module, the didactic concept of this module is presented. This includes a) the reference project as a process-

oriented curriculum, b) the learning-at-work approach, and c) organisational and technical tools for supporting the students. A summary and outlook is given at the end of the article.

2. In-service master's programme "Professional IT-Business"

More than 13,000 students study at the University of Applied Sciences Berlin in 70 different degree programmes in the areas of technology, computing, business, culture, and design. Seven of the 70 degree programmes strongly focus on computer science.

2.1. The module "Project Studies" as part of the master's programme curriculum

The curriculum of the master's programme has been designed by professors of computer science in conjunction with members of several companies, e.g., IBM, SAP, and KPMG. In the master's programme, the students earn 90 credit points, 25 credit points each in the first and the fourth semester and 20 credit points each in the second and third semester.

The courses "Cloud computing", "Analytics", and "Requirements engineering and change management" are conducted in the first semester. The course "Analytics" presents the basics for the course "Project studies I". In this course, a project focused on analytics has to be completed in the students' companies. The courses "Mobile computing" and "Enterprise architecture management" are held in the second semester. The course "Project studies II" is focused on systems design. The third semester comprises courses in "IT security" and "IT controlling". The last is also main content of "Project studies III". The students write their master's thesis in the fourth semester, supported by a master's seminar. Besides the technical and professional focus of the project studies, the students also strengthen their social skills. Project studies I is focused on strengthening the ability to communicate, in the second semester the students practice their leadership abilities, and in the third semester the project studies are focused on strengthening the skills necessary for negotiating and sales.

For the "Project studies" course, the students need attend the university of applied science only for the introductory event, the interim presentation, and the final presentation. All the work for the project studies is done at the students' companies.

2.2. Learning in conjunction with employment

In order to enter the programme, applicants must have at least one year of professional experience following their bachelor's degree. The master's programme is conducted in conjunction with employment. That means that the students work in their companies from Monday to Thursday and take their courses at the university of applied science on Fridays and Saturdays. The students' work load is very high, with 1125 hours per year.

This work load cannot be carried out without the support of the companies. The companies not only pay the study fees (currently €16,500), but also enable the students to accomplish their studies by allowing enough time for studying and placing the students in suitable

projects. As the students would be unable to accomplish their studies without the support of the companies, the companies are committed to the programme by contract.

3. Didactic concept of the project studies course

The didactic concept of the project studies course includes learning and project work that are integrated into companies' real work processes and real projects; it is process and practice oriented. This course concept builds on the concept of work-process-oriented further education and is an example of process-oriented further education in conjunction with companies (cf. Fuchs-Kittowski et al. (2001)).

The following aspects were developed in order to systematise and support the learning process as part of the work process in real projects: a) process-oriented curricula (reference projects), b) a strategy for learning as part of the work process, and c) organisational and technical tools to support the students.

3.1. Work processes as learning content (reference project as a curriculum)

The central component of the didactic concept is the process-oriented curriculum. The learning content is not defined according to subject classification, but rather on the basis of work processes. This places the emphasis on competence instead of knowledge, makes the link with practical work, and ensures comparability.

Reference projects were developed as process-oriented curricula for each semester or profile of the project study (data analyst, EA manager, IT controller). The reference projects constitute typical projects at a relatively high level of abstraction for each profile based on the characteristic work processes (or reference processes) of that profile. These reference processes consist of all practically-relevant tasks typical for a given profile performed in a typical order. Each task in the reference process is further detailed as sub-processes. The required skills, knowledge, and tools are described on this most detailed level of the workflow.

3.2. Learning in real work processes

The students learn in real-life on-going projects (practical projects), i.e., in the day-to-day work context with appropriate practical requirements. The process-oriented curricula (reference projects) are used as concrete syllabi for the projects and define the mandatory learning outcomes for each profile. They serve as the model for a) the selection of the practical project, b) the planning, execution, and evaluation of the working and learning processes in the project, and c) the proof of the successful completion of the project study.

- a) The reference project is the *benchmark for the practical project* on which the participants base their project studies. The practical project must satisfy the reference project, i.e., be sufficiently similar to the reference project to be approved for the course.
- b) The reference project provides the *structure for all the learning and work* in the practical project. In the course of a practical project, students must prepare, execute, and evaluate every task, where a task can be, for example, a sub-process of the reference process.
 - *Preparation:* The students plan the task or sub-process, reflect on their relevant experience, and independently acquire any lacking knowledge insofar as possible in advance. The reference processes help with planning by making the work processes easier to anticipate, plan for, understand, and manage.
 - *Execution:* During the work process, the students independently acquire any other necessary knowledge that was not anticipated in advance.
 - *Evaluation:* After completing the task, the students reflect on and document what they have learned, thereby securing the knowledge. The documentation and the reflexive discussion are the central means of securing the work and learning experience as well as generalising the knowledge gained during the project.
- c) The reference project establishes mandatory learning outcomes for each profile, i.e., all sub-processes of the reference project must be verifiably mastered by dealing with them, reflecting on them, and documenting them. In this way, the ability to successfully carry out a real project and acquire the necessary knowledge and skills is assessed. The specific learning content is determined by the actual project (and the prior knowledge of the participant); however, the reference projects determine the level, complexity, and scope of the abilities and skills to be gained in the undertaking.

4. Organizational and technical support

The students are given support with regard to content (seminars), personnel (roles), and technical aspects (e-learning environment) in their self-regulated working and learning process.

In terms of *content*, the students are supported by a classic taught course (lectures and exercises) offered in parallel to the project study. In this course, specialised knowledge relevant to the profile of the upcoming project (data analyst, EA manager, IT controller) is presented (for data analyst cf. Chapman et.al. 2000).

Various *personnel* with different roles are available to the students both at the university of applied science and in the company:

- *Expert advisors* are available for special, subject-specific questions.
- *Learning process tutors* support the learning process and perform the reflexive discussions with the students.
- *Organisers* are responsible for the smooth running of the project. This includes the administration of technical support.
- Problems and experiences can be exchanged with *colleagues* and other students.
- *Superiors* provide working conditions that promote learning (especially by creating the time and space for learning processes) and an appropriate learning culture (by encouraging openness among the employees and a willingness to pass on knowledge) in the company.

Technical support for all participants is currently offered via a learning and communication platform (Moodle) to:

- support *individual learning* (self-study) by providing materials and learning content,
- support *communication* between participants with the aim of joining individual and collaborative learning (e.g., discussion forums),
- support the *exchange of information* through the mutual provision of activity records (project sketches, project plans, presentations, and documentation).

5. Procedure, regulations and evidence

The “Project studies” course runs for the entire semester, thus for 6 months, beginning with an introductory event. The students and their supervisors at the company are aware of the format of the course beforehand and, therefore, try to find an appropriate project before the course starts officially. In the introductory course, the learning process tutors inform the students about the content and aim of the project studies. In particular, the tutors present the didactic concept and the corresponding reference project and processes in detail.

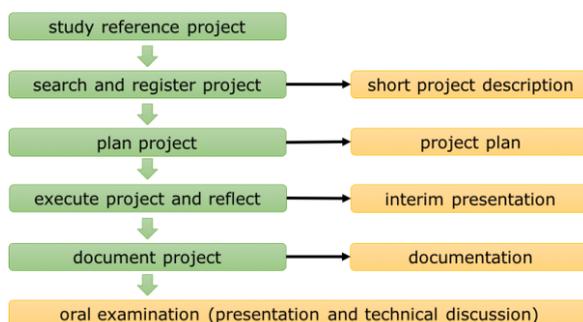


Figure 2. Procedure, regulations, and evidence

A month after the start of the course, the students deliver a short account of their projects including the project goal and a description of the organisational and professional environment in which the project will take place. Another month later, the students have to provide a project planning document containing the mile stones of the project. The students receive templates for the project description and the planning document from the tutors. The project plan must be based on the reference process for the project.

The students report on their experiences in an interim presentation and a reflexive discussion, which takes places about 2.5 months into the semester. In this way, problems in the learning and work process can be identified and solved at an early stage. However, above all, the students should be aware of their abilities as well as the gaps in their knowledge.

After this, the documentation is continuously expanded. When completed, the documentation is submitted as a basis for the examination (after approximately 5.5 months). The documentation is evaluated by the examiners with respect to the processes of the reference project and the expertise that should have been acquired (key situations also play a role here). If the documentation is evaluated positively (80% of the reference processes are completed successfully and evidence for 80% of the expertise is present), an oral examination is approved.

In the oral exam, students present their projects with regard to the most important processes and key situations, and the expertise they have gained as a result. In the second part of the exam, the documentation and presentation are orally reviewed and if necessary, the student can be questioned about expertise that is deemed to be missing.

6. Summary and outlook

In this article, the concept of the project study in an in-service master's IT programme has been presented. The aim of project study is the acquisition and promotion of occupational competence. Integrated working and learning takes place as part of real projects; these projects are process-oriented (learning as part of the work process), experience-guided (work itself is something to learn from and reflect on), self-regulated (the students regulate their own learning process with supervision), and participant-oriented (the workflow is different for each individual project, but the learning content is not random or arbitrary).

Students in the course learn as part of the work process in real projects (practical projects) in (their) companies. The students organise the learning-at-work themselves but receive extensive instructional, personal and technical support. A process-oriented curriculum, or reference project, provides the structure of the project study. It serves as a model for the selection of the practical project, the planning of the working and learning processes, and also the proof of the successful completion of the project study. All processes of the reference project must be verifiably mastered by dealing with them, reflecting on them, and documenting them.

Using reference projects as curricula is one of the fundamental ideas of the concept of the course. The process-oriented structure offers major advantages: as the processes are relatively fixed, they provide a common thread through dynamic technical and technological change. Due to the fact that the reference processes and sub-processes are modelled relatively abstractly and the skills and expertise are formulated on the meta level, many different forms of professional and entrepreneurial projects are possible. For the project study, real projects can be identified using the reference processes, which, despite having individual characteristics, contain general, comparable requirements.

The students are given a uniform approach to projects that can otherwise be very different, both technologically and organisationally. This allows students to more easily exchange information and ideas with each other. It also gives students the framework in which to reflect on their own activities, thereby supporting the development of diverse skills. Last but not least, the process-oriented structure allows an objective assessment of the projects up to certification by appropriate certification bodies.

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Insights into the expectations of mobility students: the impact of Erasmus in their future professional careers

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Abstract

At the celebration of its 30th anniversary, Erasmus is recognised as the most successful exchange program ever implemented. The prospects of attaining a common European consciousness challenged the program's ability to blend together knowledge, attitudes and skills in a winning combination. It is no longer sufficient to communicate and integrate: mobility should actively foster skills to support students's professional career at national and international levels. Although literature on mobility is vast and interesting, studies on the impact of the mobility experience in the students' future employability profile rarely provide first-hand data on their expectations in this regard. This exploratory research comprises a qualitative focus group approach with Erasmus students during their exchange period in a Portuguese university and collected some insightful data on how students consider their mobility in terms of new learning outcomes, the professional value of the experience and the development of new skills. Results indicate that students seem to be quite aware of the positive implications of mobility in their professional careers and of the set of skills developed during that period. Overall, this article contributes to demonstrating the importance of assessing skills development during Erasmus mobility experiences. Managerial implications and suggestions for future research are provided.

Keywords: *Erasmus mobility program; employability skills; career impact of Erasmus; mobility students; Erasmus students' skills.*

1. Introduction

More than 3 million individuals have already benefited from the Erasmus mobility program and for 2014-2020 alone the initiative is expected to contemplate another 5 million citizens. These numbers justify, by themselves, the extended literature around this mobility phenomenon and the recommendations for the need of evaluating its qualitative effects (Huják, 2015), that is to say the need of balancing the paybacks and value created with such programs (Bracht *et al.*, 2006; Engel, 2010).

An important aspect to think through is the relevance of the mobility to the future professional careers of these students. In fact, the goals of internationalization include both blurring national frontiers and preparing students for professional paths in a globalized world, making international careers becoming more and more desirable and a natural consequence (IEREST, 2016). As several authors (e.g., Huják, 2015; Paige *et al.*, 2009) emphasize, the positive impact of the host universities' online communication in a future global career and employability expectations seems to indicate that the international skills acquired or developed during student mobility are an essential outcome.

This research intends to explore students' expectations on the impact the mobility experience may have in their professional careers, together with the set of skills acquired or developed during that period. A qualitative exploratory approach was adopted comprising focus groups composed of Erasmus students that spent at least one semester at the University of Aveiro, Portugal.

2. Literature review

The European Commission's primary objective with the Erasmus initiative was to encourage an inclusive approach that would bind together cultural enlightenment, interpersonal experiences, linguistic challenges, academic enrichment and professional opportunities. At the heart of the program was the institutional will and commitment to improve Europe's competitiveness in a knowledge and digital society through education and training. If up to recent years integration and European identity issues were considered the leitmotiv that set in motion hundreds of thousands of students, there seems to be a new trend emphasizing the need to redirect the focus to employability skills. It is a fact that the vast majority of students choose to embark on a mobility experience in their first cycle of studies, probably not pondering too much on whether their adventure will be converted in a real asset when applying for a job or when actually performing the job. In turn, industry practitioners in general have been paying special attention to the assessment of the intangible aspects of 'mobile' applicants and tend to value an holistic approach of graduate's profile, rating their employability potential in line with a recommended set of interpersonal,

management and academic skills including, among others, communication and language proficiency, initiative, motivation, planning and organizing, time management, problem-solving, self-awareness, teamwork spirit, research and innovation, decision-making, problem solving and resilience capacities.

Extant literature provides rich contributions on the motivations to student mobility, including speaking a new language, improving communication abilities, and enrich personal development through independence and confidence (Van Maele, *et al.*, 2016). Mobility is also referred as an opportunity for students to learn something new about themselves and enhance their cultural horizon. Still, doubt remains on the impact of mobility experiences on professional and employability skills (Coleman, 2015; Paige *et al.*, 2009). While some studies (e.g., Bracht, *et al.*, 2006; Engel, 2010) report positive impacts of students' intercultural learning in their professional development, others argue that exposure to a new environment is not sufficient to have an impact on their careers (Alfranseder, *et al.*, 2011). Moreover, several studies (e.g., Lesjak, *et al.*, 2015; Van Mol & Ekamper, 2016) concluded that students are mainly motivated by experiential goals (personal growth) and not by academic or professional goals (professional growth). Nevertheless, Lesjak and colleagues (2015) showed that students tend to choose developing countries due to the increased probability of encountering new educational systems and employability opportunities.

Regarding the expectations that students realize in employment opportunities after participating in an Erasmus program, González and colleagues (González, *et al.* 2011) argue that there are some differences across regions. These authors determine that both European and American students are motivated by better job opportunities. However, European students hoped that this experience would increase their chances of employment outside their home country while American students hope for better employment opportunities within their home country. Several other studies (e.g., Findlay, *et al.*; Lesjak, *et al.*, 2015) point out that the knowledge of foreign languages, especially the most common ones, is perceived by students as having a strong impact on a future professional career. So, this appears to be the main reason why students go abroad, and not only to complement their core studies (Lesjak, *et al.*, 2015).

3. Methodology

Taking into account the contributions collected in the literature review and the proposed research objectives, a qualitative exploratory approach was adopted with the purpose of assessing students' perceptions and expectations on the impacts of mobility on their future professional careers. The phenomenological interview is an inductive methodology guided by a central question that attempts to identify a specific phenomenon by providing the actors total freedom of expression and reasoning.

A convenience sample was defined comprising a total of 15 students on mobility in the University of Aveiro in the Fall/Winter semester 2016. Focus group interviews were organized into three topics: (i) What do Erasmus students learn during the mobility experience that otherwise could not have learned?; (ii) How valuable is the Erasmus experience expected to be for their future careers?; and (iii) What new skills do Erasmus students develop? The focus groups were held in mid-December so participants had been in Aveiro for three months and about to conclude their exchange semester.

Table 1: Sample characterization

Focus group	Gender	Continent	Country	Age	First Mobility Experience?
1	female	Europe	Czech Republic	22	yes
1	female	Europe	Czech Republic	22	yes
1	female	Europe	Italy	23	yes
1	female	Europe	Latvia	22	yes
1	female	Europe	Poland	21	yes
1	female	Europe	Poland	21	yes
2	female	America	--	21	no
2	male	America	--	22	no
2	female	Europe	Spain	22	yes
2	male	Europe	Spain	22	no
3	male	Asia	--	36	no
3	female	Europe	Italy	23	yes
3	male	Europe	Italy	26	no
3	male	Europe	Poland	25	yes
3	male	Europe	Romania	24	no

Although the study used a convenience sampling method, groups (see Table 1) were organized in order to meet a balanced homogeneity and heterogeneity of participants within groups. Focus group 1 (FG1) comprised only females on their first mobility experience, focus group 2 (FG2) had only Spanish language natives, and focus group 3 (FG3) was composed of the oldest participants in this study. The majority of participants belonged to the study field of humanities and social sciences - management, economics, accounting, finance, marketing, communication. All the interviews were audio recorded with the agreement of all participants. Content analysis' techniques for contextualized interpretations were used.

4. Results

As seen in the literature review, the increase in students' mobility can be associated with the expected outcomes acquired or developed during the exchange period, regarded as an initial groundwork for a professional career in a globalized world (IEREST, 2016), fostering independence, confidence and broad-mindedness (Van Maele, Vassilicos, & Borghetti, 2016), while enriching the educational environment (European Commission, 2015). The scope of developed skills is large, with a clear improvement of intercultural, interpersonal, management, communication and language competences, valued by all as fundamental, and resulting in a better performance and more professional opportunities.

4.1. Skills developed during the Erasmus mobility

As Alfranseder, *et al.* (2011) mention, an Erasmus' experience creates different learning opportunities. First of all, the practice of a language that is not the mother tongue. This aspect was extensively mentioned by the students and seems to be very challenging: "*I learned to make myself comprehensible above and beyond the idiom barrier*" (FG2) as "*the only option you have is to speak English daily and you do so because you want to communicate with others*" (FG2), and because of that "*I learned not to be embarrassed of speaking in another language*" (FG2). The desire to improve language proficiency skills was not reduced to English: "*Of course, Portuguese language itself... it's so cool, you got a lot of more perspectives*" and "*you become less shy, kind of open up*" (FG3). For some, this was actually a mandatory aspect of the mobility: "*I just wanted a different idiom.*" (FG2)

In line with Van Maele, *et al.* (2016), we found that communication and integration played a major part in the mobility expectations of students: "*it is very important to be integrated with other Erasmus and with Portuguese people ... in order to assimilate the new culture*" (FG2). Participants also shared the idea that their Erasmus' experience taught them "*to leave your comfort zone, learn by yourself ... be far from home and be comfortable*" (FG2). Moreover, the mobility experience was clearly valued as an opportunity to develop other

skills: *“with the international experience one can develop competences that could not be improved if no mobility took place”(FG2) like “the ability to be independent, to decide... to manage money, time, to make me understandable with others and to understand another culture” (FG2). The responsibility of being on their own was probably the strongest feeling: “you have to think about doing things and do them well.” (FG2)*

4.2. Expected impacts on a future professional career

Although the literature review indicates that the decision process is not grounded in future professional career expectations, this study found evidence in students' perceptions that sustain a sound awareness of the benefits that an international experience could provide and that may indeed constitute a fundamental motivation for mobility. Following Huják (2015) and Paige *et al.* (2009), the participants in this study agreed that the skills acquired and developed are *“almost compulsory competences at international level... for everybody who wants to go further... develop on one's own, be less afraid of challenges that work might bring” (FG2).*

Communication skills are a central point for a future professional career. In fact, participants seem to follow the conclusions of Findlay *et al.* (2006) and Lesjak *et al.* (2015), when they consider that *“learning Portuguese can open doors in my future professional career as, for instance, you can work with Portugal and then the language can open doors” (FG2).* More specifically, in what regards the most common languages, students are unanimous about the advantages of practising and improving their English: *“speaking English daily it was very hard... in globalisation everyone needs to speak English” (FG2),* emphasizing that *“in multinational companies we have to be able to talk in English” (FG1).* Along with linguistic competences, comes self-confidence: *“to speak more languages makes us more competitive, more attractive to a company” (FG2)* and better interpersonal skills: *“if you work for an international company..you can learn more about the culture...and now i'm able to talk with other people... and talk about myself” (FG1).*

The fact that students are integrated in a community with many nationalities also contributes to their intercultural abilities, aligned with Huják (2015) and Paige *et al.* (2009): *“the integration with other Erasmus and Portuguese students too... different people of different cultures gives you news perspectives of the world... how people think, how people do business, how people act in different parts of the world regarding the same thematic” (FG2).* The perceptions on the impact of social skills in their professional career is equally mentioned and considered: *“...almost mandatory competences in multinationals ... to know how to manage with people from different countries, to communicate with them” (FG2).*

Another strong added value mentioned in the literature that results from an Erasmus' experience is a broad set of competences covering personal and social skills (Van Maele, *et al.*, 2016), such as organization and planning: "*I learned to question my time... you just simply have to organize yourself... and you find you have time for everything*" (FG2).

Overall, the participants in this study agreed with the idea that the mobility experience prepares them for an international career, emphasizing that "*I will consider working abroad after Erasmus ... Now it seems much easier*" (FG3), because "*I'm not scared of new adventures*"(FG1), "*[I am] less frightened... [I have] less stereotypes*" (FG3). All these messages seem to reflect the image that students are clearly aware of the possible outcomes of mobility and paying attention to what is expectable from them as future employees: "*that is very important because we live in a globalized world and more and more globalized and attentive*" (FG2). However, students evidenced some doubts regarding the positive assessment of these employability skills by employers: "*For an employer, many don't like a person that travels too much or spends few time in one location... if you have an international experience... if you have studied abroad... it depends on the employer...*" (FG3), indicating that there are in fact rather strong expectations on the impacts mobility could import to their professional careers, questioning the appraisal of mobile applicants' employability profiles. Still, "*some experience is better than none*" (FG3) and being an Erasmus turns out to be something irreplaceable: "*...as soon as you join the erasmus you feel this thing... Erasmus people or other international students are a kind of similar group, a niche group, people that have a kind of special perspective of life and of Europe ...the idea that the word is open and that you can go anywhere and you can do anything*". Thus, this study provided evidence of the perceived impacts on future professional careers in line with what is suggested by IEREST (2016), but emphasizes the complexity of both the relevant skills and their expected impacts, depending on the amplitude of professional opportunities and even the perceptions of the employers themselves.

5. Conclusion

Despite its exploratory nature and scope, this research provides rich empirical evidence on the wider sphere of skills perceived to be developed during student mobility. Moreover, these skills are viewed as fundamental for the participants' future professional careers. While extant literature tends to position professional skills development as a second order reason to spend a semester in another university, this study shows that the implications on future careers are not disregarded by Erasmus students, and in some cases the mobility may trigger international plans beyond the academic stage. Overall, students seem to be clearly paying attention to what is expectable from them as future employees, and that may give employers all the reasons to pay special attention to a deeper assessment of the intangible

aspects of 'mobile's applicants. In order to foster these important implications and outcomes of Erasmus mobility, universities should provide challenging learning experiences to maximize skills development opportunities, while preparing their students in order to take full advantage of mobility abroad. Again, the evaluation of acquired and developed skills is essential for assessing the success of mobility initiatives.

One brief note on limitations of this study, the main being the scope and dimension of the sample. Thus, new data from new samples, namely from students hosted by universities with both similar and distinct characteristics from Aveiro's, are needed for result validation. In addition, we focused on students' views and expectations, and it will be essential to consider also other parties' views, namely employers, as well as appraising the real outcomes of professional careers by studying former mobility students.

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The Interactivity of a Virtual Museum at the Service of the Teaching of Applied Geology

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Abstract

In a framework in which teaching practice is a dynamic process, predisposed to continuous innovation, the Geological Collection of the University of León (CGULe), with 2000 copies of minerals, rocks and fossils, offers an opportunity for teaching innovation, in relationship with subjects of the geological disciplines that are taught in the Degrees of Mining Engineering and Energy Engineering.

At <http://laboratorio.wesped.es/>, the first phase of development of the Virtual Museum of the CGULe is shown, where information and images of minerals and mineral deposits from León are offered. Likewise, videos of tests of characterization of minerals, made by students as a practice of the subject "Mineralogy and Petrography" (Degree in Mining Engineering), are offered as part of a teaching innovation. This teaching innovation was evaluated in two ways: a) comparing the academic results of students in this practice with equivalent results from previous courses and b) conducting a satisfaction survey. Given the small number of students who participated in this experience, the results of this evaluation are inconclusive. For this reason, teacher innovation will be extended in time and will be extended to other subjects of the above mentioned degrees.

Keywords: Teacher innovation; Mineralogy; Ore deposits; virtual museum.

1. Introduction

Museums throughout history have changed in their conception and have gone from presenting a mere collection of knowledge to being one of the best didactic resources at the service of people. Methodologically, virtual museums can be an educational resource in which to present motivational virtual activities that dynamize the teaching-learning process and foster creativity and scientific vocations.

The Geological Collection of the University of León (CGULe), has around 2000 specimens of minerals, rocks and fossils and is located in the facilities of the Superior and Technical School of Mining Engineers of this university. In a framework in which teaching practice is a dynamic process, predisposed to continuous innovation, CGULe offers us a unique opportunity for teaching innovation, especially in relation to the subjects of "Mineralogy and Petrography", "Geology", "Minerals" and "Stratigraphy and Paleontology" taught in the Degrees of Mining Engineering and Energy Engineering.

There are numerous antecedents of creation of virtual museums related to geological disciplines (i.e. Fernández Caliani, 2011; Tambuyser & Hootelé, 2011; Griem, 2015). In this paper, the results of the initial development phase of the Virtual Museum of the CGULe (<http://laboratorio.wesped.es/>) are presented. The work carried out is linked to a pilot teaching innovation project at the University of León, which was carried out on a small number of mineral samples from León metallic deposits. This theme was chosen because of its local singularity, since possibly no other museum has the capacity to present an equivalent exhibition.

2. Metodology

In the first phase of construction of the CGULe Virtual Museum shown in this article, the platforms Thinglink and Wordpress were used (<https://srd.wordpress.org/plugins/thinglink>), with a plugin that allows to make images interactive from a website by tagging with Rich Media Tags like YouTube, SoundCloud, Spotify, Amazon and many others. The work was structured in three sections: the musealization of the minerals and deposits from León, the realization of videos of the tests and the evaluation of the teaching innovation related to the construction of the museum. They are described in detail below:

2.1. Virtual Musealization of Reserves and Mineral Species

A map of the deposits of the main minerals of interest has been made. Based on information compiled from specialized magazines, a descriptive file has been made of each of the main mines.

On the other hand, relevant samples of minerals from these deposits belonging to the CGULE have been photographed and a descriptive sheet of each mineral species has been made.

2.2. Videos of Mineral Characterization Tests

The students of the subject "Mineralogy and Petrography" of the 3rd year of the Degree in Mining Engineering (course 2016-17), in groups of two and under the supervision of the teacher of the subject, elaborated scripts and made videos on significant physical-chemical properties for the identification and classification of minerals.

2.3. Evaluation of teacher innovation

The work described in the previous section was carried out by the students as a practice of the subject "Mineralogy and Petrography", which implied a teaching innovation with respect to previous academic courses, whose effectiveness was evaluated in two ways:

- Comparison of the grades obtained by the students in the practice of "Recognition and classification of minerals" with grades obtained by students in the three previous academic courses.
- Satisfaction survey completed by the students. The sections of this survey that are detailed, together with the results, in section 3.3.

2.4 Technical Description

The core of the Mineral Museum website is a Wordpress CMS (Content Management System) (WordPress, n.d.) running in an Apache Web Server. Wordpress is the most popular CMS due to it is easy to use and maintain. This CMS can work with multiple plugins such as DIVI and Thinglink (Thinglink Company, n.d.). DIVI is a visual Wordpress theme editor that allows to develop web content without the necessity to have advanced knowledge in a specific language programming such as HTML or PHP. On the other hand, Thinglink has been used as a basis for linking to the interactive image management platform. Video content has been supported by Youtube, uploading the videos from the students and teachers's institutional accounts. After that the video content can be linked with Wordpress easily to be included in the Mineral Museum.

3. Results

3.1. Virtual Musealization of Reserves and Mineral Species

As a result, the site <http://laboratorio.wesped.es/> has been created where all the information indicated in section 2.1 is hosted.

Figure 1A shows the museum home page. For each one of the mineral deposits located in it, we find: images of the deposit itself (Fig. 1B), images of minerals from that deposit (Fig. 1C and 1D), descriptive records of each mineral species (Fig. 1E) and a descriptive analysis of the main site (Fig. 1F).

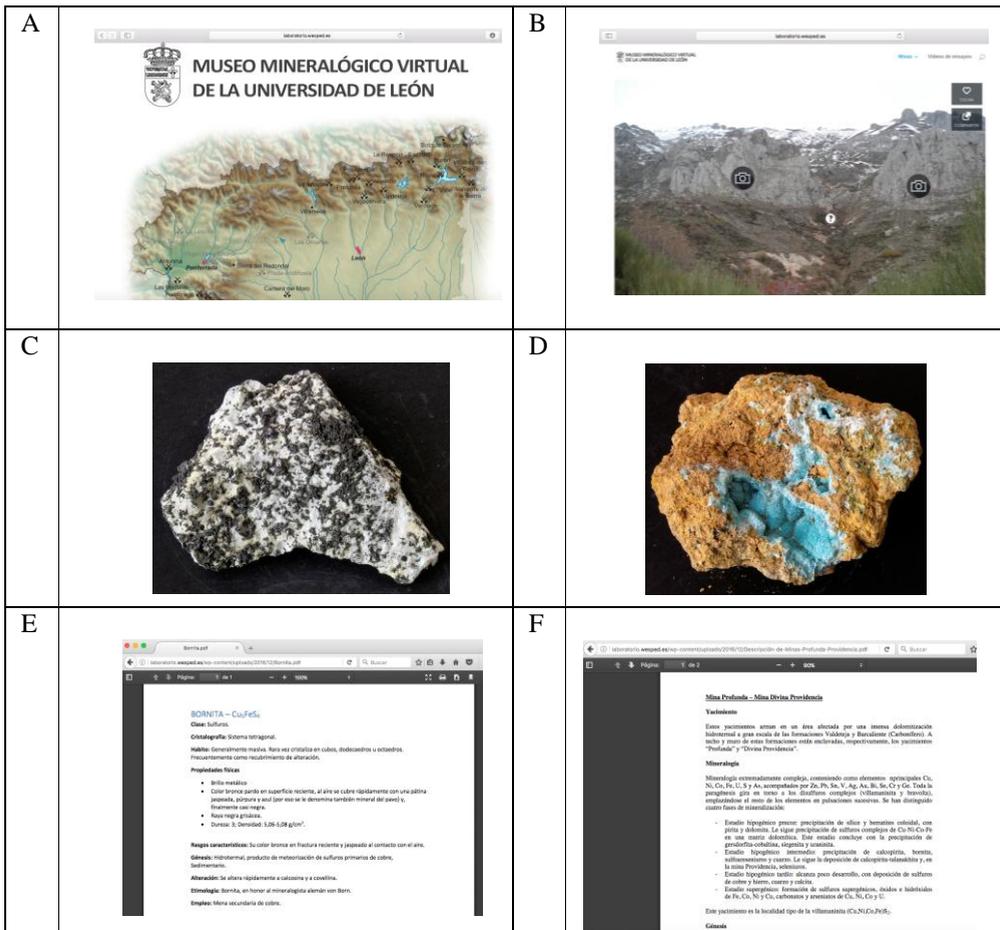


Figure 1. Examples of information available at the virtual museum.

3.2. Videos of Mineral Characterization Tests

A selection of videos on physical and chemical properties of minerals, made by students, is available on the Youtube platform through the link "Videos of Essays" created at <http://laboratorio.wesped.es/>.

Specifically, videos are exposed on the following properties: color, ray, magnetism, exfoliation, hardness, birefringence, fluorescence and reaction to HCl (10%) in cold.

3.3. Evaluation of teaching innovation

Of the 16 students enrolled in the subject "Mineralogy and Petrography" 10 participated in the teaching innovation activity.

Academic qualifications. The average score obtained by the students in the mineral recognition test, after the teaching innovation, was 5.8 points out of 10. This grade is of the same order of magnitude as those obtained in the previous three academic years (5.5 points out of 10), although slightly superior to it.

Satisfaction survey. To the question: do you think that you needed more explanations prior to the realization of the practices?, 70% of the students believe that the explanations were sufficient (Fig 2).

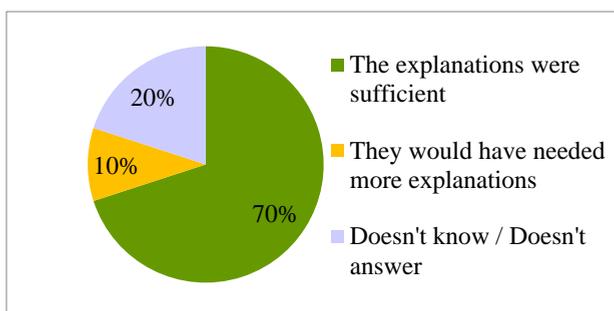


Figure 2. Comments on the training prior to the implementation of the practice.

Other sections of this survey were:

A1. The practice of video recording of the tests of physical properties of minerals has been useful and simple.

A2. The elaboration of the scripts of the videos realized has been useful and simple to me.

A1. The fact that the best videos made by the students would be uploaded to the virtual museum has positively influenced my motivation when doing the practice.

A4. I think I've learned more than if I had done a conventional equivalent practice.

A5. Is the practical methodology developed adequate for the subject "Mineralogy and Petrography"?

A6. I would like the other practices of the subject to be related to the development of the virtual museum.

A7. Do you think that the participation of the students is interesting for the development of the virtual museum?

The answers obtained in each of these sections are shown graphically in Figure 3.

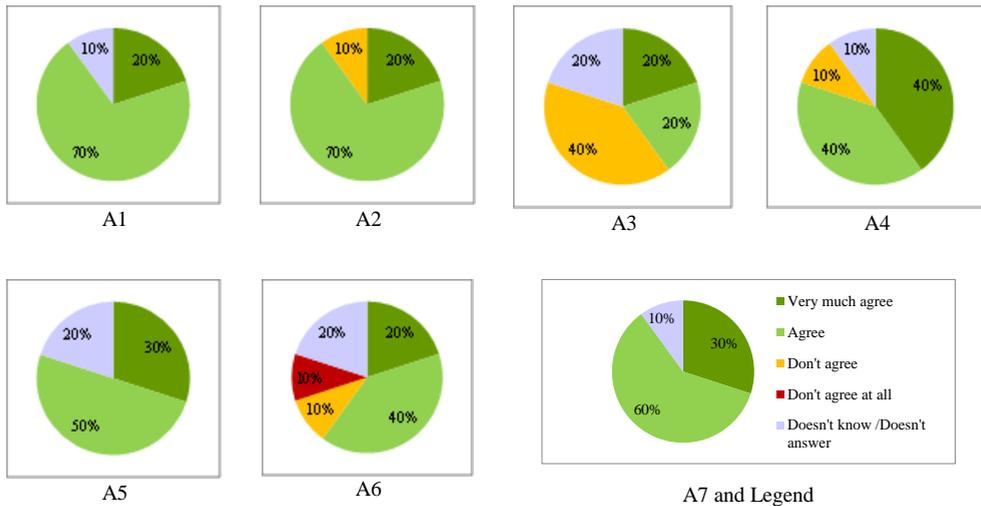


Figure 3. Pie charts showing students' responses to the satisfaction survey.

Students were asked to suggest what was the most and the less interesting aspects to them when realizing this experience and the answers are collected in Figure 4.

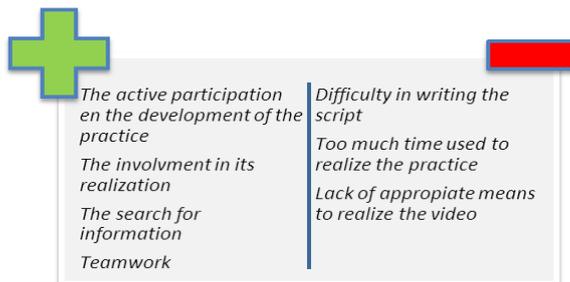


Figure 4. Comments on the practice.

Some respondents have made suggestions for future practices, that point toward to consider to carry out and expand this kind of experiences, as well as implement technical support when making the videos, to improve their quality.

4. Discussion

Virtual museums 2.0 are a very powerful tool for disseminating information, and also facilitate and enhance the interaction between institutions and the public (Capriotti et al., 2016). In this experience, the University of León and the students are linked by the creation of this Museum experience. Also, the creation of the virtual museum is a first achievement, related directly to the teaching innovation in the subjects "Mineralogy and Petrography", of the Degree of Mining Engineering.

The academic results of the practical test of mineral recognition, performed by the students after the teaching innovation, are of the same order of magnitude as the equivalent results of previous academic courses. Although the results of the survey completed by the students show a high satisfaction with the teaching innovation carried out. They also show the desire to extend the experience to other practical contents of the subject, pointing out also show some room for improvement. Given that the number of pupils who have participated in this teaching innovation is very small (10), the interpretation of the results obtained, so far, has a very limited validation. For this reason, teaching innovation will be extended during the next course to the subject of "Geology" (Grades in Mining Engineering and Energy Engineering) and in subsequent courses of the subjects "Mineral Deposits" and "Stratigraphy and Paleontology" (Degree in Mining Engineering).

5. Conclusions

One of the main objectives of the project for the creation of the website of the virtual museum, can already be consulted at <http://laboratorio.wesped.es/>. It is a web page in its initial phase of development, whose growth is projected into the future. The museum currently shows information that corresponds to metallic deposits from León and some minerals from these deposits. The museum also shows videos with information on methodologies of tests for identification and characterization of minerals. These videos were made by students of the subject "Mineralogy and Petrography" (Degree in Mining Engineering) within a framework of teaching innovation while the practices of this subject.

The evaluation of this teaching innovation has been carried out in two ways: a) Comparison of academic results of students with the equivalent results of previous academic courses and b) Conduct and analysis of satisfaction surveys. Only the ten students who had to surpass

the practices of this subject participated in these surveys. Given the small number of the samples, the results are inconclusive. However, they serve as a first approach to debug future lines of work. Hence during the current and future courses it is intended to extend the sampling to students of other subjects of the Mining Engineering and Energy Engineering degrees in order to obtain a reliable evaluation of teaching innovation projects linked to the development of the museum.

Acknowledgments

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Block Teaching as the Basis for an Innovative Redesign of the PG Suite of Programmes in University of Bedfordshire Business School

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Abstract

This paper aims to provide a first evaluation of the University of Bedfordshire Business School's innovative attempt to develop a new suite of Masters Programmes that delivers in terms of academic rigor and employability requirements while providing a rich student learning experience. The new delivery is based on a block delivery model that rationalises the previous offerings by providing a smaller range of standardized large units which are more tightly integrated to each other and are part of courses with particular characteristics such as a four-tier induction system (with inductions being progressively more employability-focused as students' progress from one unit to the next) and the final capstone unit where students have a choice between a traditional dissertation and an experiential final project. That common architecture is coupled with a flipped classroom delivery style, utilization of blended learning and rich peer-to-peer learning opportunities with multiple entry points providing additional students into the cohorts for each unit. Preliminary data is provided here as an early evaluation of the approach's effectiveness and efficiency in terms of the delivery experience, the assessment strategies, the levels of student engagement and performance, as well as the experience of staff and students.

Keywords: *Block Delivery; Flipped Classroom; Blended Learning; Employability; Student Experience*

1. Research Context

The University of Bedfordshire Business School (UBBS) has been offering a range of Masters programmes since early 2000s. The postgraduate portfolio has evolved in recent years to accommodate recent developments: the choice of adopting a practice-based curriculum in UBBS, the dramatic changes in market demands, especially in the international student recruitment, more recently the focus on employability (HEA, 2013) and the introduction of TEF. In addition, UKVI challenges and changes in staffing composition have motivated a rationalisation and redesign of the Masters provision to enable building on established strengths whilst providing the School with a differential advantage.

In order to address competition and expectation issues within such a dynamic market, UBBS, led by the new faculty management team, has recently developed a new and innovative suite of MSc programmes with a focus on gaining further professional, statutory and regulatory body (PSRB) accreditations. The suite of programmes is based on a block delivery model that aims to rationalise the offerings by coalescing around six entry points per year and a standardised size of units (30 credits). This replaces the 11 entry points the school was previously running with a plethora of units of various credit sizes and repeated deliveries due to multiple entry points. The reduction in the overall number of units (from over 700 to around 50), a greater level of unit sharing across courses and the implemented block delivery model has enabled Heads of Department to efficiently manage staff time within the workload planning model. The overall design offers the following structural and pedagogical advantages over the previous delivery pattern:

- No pre-requisites; students do the unit that is running for their course when they join.
- Intensive induction week specifically aimed at preparing students for the learning experience rather than being solely articulated as an introduction to the institution and course. That includes the international students who due to visa challenges, often arrive late. Within the block delivery structure, late arriving students are accommodated in a ‘step up to masters’ course and then wait to join the full course at the next intake ensuring they do not miss any of the teaching for their course.
- Intensive, flexible classroom delivery in six-week blocks utilising blended learning; currently full-time with the potential for expanding into part-time, single unit or other patterns of study in order to fit with individual and/or employer requirements
- Inter-block period utilised to structure the four tier induction process and provide an opportunity to step back and think about course level learning outcomes, personal goals etc.

- Rich peer to peer learning opportunities as multiple entry points provide additional cohort numbers to each unit.
- Scope for greater variety in terms of speakers, live projects, field trips as staff are not trying to coordinate everything in a traditional timetable often comprising of a 2-hour window once a week.
- No options until the final capstone when they have a choice of traditional dissertation or experiential route
- Personal development woven through the course as professional practice, and live project opportunities integrated into the curriculum (and particularly the final capstone)

The stakeholders were involved early on with the development of these new masters programmes. The faculty steered towards an integrated holistic change of the offering to conform with the philosophy outlined above. Professors of practice were involved in the practice/employability aspects of the curriculum, while the students via committees and focus groups were consulted in the development of interesting and relevant assessments.

Within the block delivery structure, students study 1 unit at a time and focus on only one assessment at a time. This concentrated focus has enabled students to explore topics in greater depth developing a level of criticality appropriate for level 7 education. Flipped classroom, practice-based and action-learning setups have been developed to assess students' learning and wherever possible the assessments are rooted in authentic and practical workplace scenarios to enable experiential learning. Particular emphasis has been put on the masters 'capstone experience' assessments allowing for greater integration and synthesis of learning.

The PG Suite of Programmes, at the time of writing, have recruited their first four intakes of the current academic year (2017/18). The block teaching delivery of the new programmes is in process. Thus a preliminary effort to evaluate these new programmes and examine their impact on pedagogic areas of importance such as the delivery and assessment strategies, the student engagement and performance, the experience of staff and students, as well as the courses' overall effectiveness has been undertaken. The business school has committed a group of academic staff to conduct a two-year longitudinal research with students and the teaching teams of the PG programmes. This paper reports the outcomes of the initial unit surveys and course learning experience surveys for the first 3 blocks.

2. Literature Review

The ‘flipped classroom’ or ‘blended learning’ technique in pedagogic teaching has had a resurgence in recent years due to advances in technology, in particular mobile technologies, and institutions seeking to respond to student engagement, retention and progression challenges (Kurtz et al., 2014). It provides a mechanism for engaging students in their learning in a different way to more traditional models of teaching content in class. Technology innovation has facilitated a number of innovative pedagogies in higher education. Blended learning for example has had a strong impact in both practice (Unger et al., 2013) and Higher Education (Erdem & Kibar, 2014; Lou et al., 2012; Wu et al., 2010) and is particularly suited to university courses where lecture content can be made available online and class time can then be prioritised for active student engagement (Boyinbode et al., 2013; McCarthy, 2010; Stacey & Gerbic, 2007). The blended learning model is based on social constructivism, a student-centred learning theory that stresses the need for collaboration among learners and practitioners.

As Jensen et al. (2015) point out, only limited studies on the flipped learning model exist. The authors conducted a study into the effectiveness of this model using a quasi-experimental design comparing an active non-flipped classroom with an active flipped-classroom and found no difference in the level of learning gains and also equivalent satisfaction with the course. They concluded that an active learning style of instruction is more likely to result in higher learning gains rather than the order in which the instructor participated in the learning process. In line with extant studies, the School’s block teaching embedding flipped classroom and blended learning are seen to support active learning and enhance students’ learning experience and are fundamental to achieving the personal and professional development aspirations of the newly developed courses.

3. Research Methodology

After a preliminary literature review, a mixed method approach has been adopted for the data collection; student performance data and utilising the standard. University unit survey process supplemented with the Course Experience Questionnaire (CEQ), a well-established research tool around learning gains and the student experience. Furthermore, the CEQ also includes student learning preference and teaching orientation questions with a view to develop an insight into how learning preference orientations impact on students perceptions of satisfactions.. The outcomes from these sets of data will be triangulated to validate the final results and these will be further tested and explored via focus groups with students.

A longitudinal research design will be used to collect data. All three sets of data will be triangulated within a mixed methods research paradigm thus adopting a pragmatic perspective in the data collection and analysis. The data collected will be analysed systematically to draw conclusions, e.g. by comparing and contrasting between different

intakes of the same course, and between different courses of the same time period. The aim will be that the outcomes from each of the intakes will be used to improve the teaching and delivery for subsequent intakes so that through this iterative process, these new Masters' programmes will be progressively improved and their quality enhanced.

While the unit survey is conducted at the end of every unit, the CEQ survey is repeated at every three blocks' interval. Thus, responding students on the CEQ will be at different stages in their learning journey. Some of the students may have completed one unit, some two and yet some more than two, depending on when they enrolled. This approach will allow the project team to understand students' perceptions regarding the teaching quality of the block-teaching diachronically; and at the same time to compare if there are differences among the perceptions of responding students across the whole learning journey.

The CEQ survey data will be analysed using SPSS with factor analysis used to identify the key factors that affect students' perceptions about the quality of the block-teaching. ANOVA will also be used to compare whether students at different stages or with different demographic characteristics have different perceptions.

Qualitative semi-structured interviews will be conducted to understand how and why students' perceptions are formulated and changing. This will allow the project team to develop an in-depth understanding of students' perceptions with regards to the quality of block-teaching, which will complement the finding from the questionnaire survey. NVIVO will be used to analyse the interviews.

In addition, focus groups with staff post-delivery of a unit will be conducted to evaluate the staff experience of teaching in the block delivery structure. This will be further supplemented with a staff experience questionnaire and interviews during the phase 2 of the project.

This paper presents the following information: A) The overall results of the unit surveys for the first two blocks of all MSc programmes as compared to those of the previous year (2015/16); B) The results of the first CEQ survey of the first three intakes of the year; C) The qualitative feedback from both unit survey and CEQ survey; and D) The results of the staff focus group that followed the delivery of the first three blocks.

4. Findings

4.1.1 The outcomes of the unit survey

Table 1 encapsulates the overall assessment performance for the first two blocks of all PG programmes vis-à-vis the results for the previous year's cohort: (At the time of writing, the assessment boards had not taken place for block 3) The performance data for the previous year included main and resit results whereas the blocks data is based purely on the first sit assessment results.

Table 1 The overall performance of the first two blocks of the PG programmes compared to the previous year

	<i>2015/16</i>	<i>Block 1 first sit</i>	<i>Block 2 first sit</i>
Pass Rate	92%	90%	86%
AB rate	32%	44%	48%
#Academic Misconduct	140	4	1

As indicated, AB rate was significantly improved; this is not due to a lowering of assessment standards as externals have commented that, in many cases, the assessments are actually more challenging. The number of academic misconduct cases has fallen dramatically. Possible explanations for this are the more structured management of late arriving student who no longer need to meet an imminent deadline having missed a significant amount of the teaching and the opportunity within block delivery for better relationships to form between staff and students which is highly motivational for both sides. Furthermore,; focussing on one assessment at a time helps the students produce higher quality work and assessments are more closely tied in with the learning experience.

Overall the first block delivery was successful. Across 10 different units of delivery across the whole portfolio the unit surveys showed very high levels of satisfaction ranging from 80% to 100%. Some of the highest performing courses are the ones with the smaller cohorts (II/V/VI) however there is one exception (III) which had 17 students and yet scored very high in satisfaction. Conversely some of the comparatively lower satisfaction courses (I/X) also had smaller cohort sizes therefore satisfaction was not apparently coupled to cohort size. The overall student results were satisfactory in terms of good grades.

The free text qualitative comments were quite uniform across all units and table 2 summarises the main themes emerging,

Table 2 Comments from the unit surveys of the first intake of the PG programmes

<i>Title of the Unit</i>	<i>No. of positive comments</i>	<i>Examples of good practice</i>	<i>No. of negative comments</i>	<i>Examples of areas for improvement</i>
I. Accounting and Finance	2	Learning and understanding new things about finance and accounting	2	More practical application is needed in order to adopt more what we learn
II. Digital Analytics	3	Interesting topic Enthusiastic tutor	2	Getting used to block teaching
III. Employment Law	8	Good helpful tutor	4	Assessments set to test time management rather than intellectual ability
IV. Financial Market	11	Practical, practice of theory Allows for autonomous learning Deep and better understanding	6	Not enough guidance for assessments
V. Global Logistics and Supply Chain Management	7	Helpful tutor Good interactive sessions and extensive guided learning	5	Too intense Too theoretical not enough practice
VI. Intellectual Property	4	Good starting point for LLM Discussion forum interactive tutor	4	Room is freezing (x3) Block delivery system takes time to get used to
VII. Intercultural Business Competencies	26	Good teaching Impressive delivery Interactive	21	Too much information Too little time More advise for assessment
VIII. Leading and Managing Organizational Resources	17	Clearer understanding; critical thinking friendly class atmosphere	19	More information about assessments Time scheduling

IX. Project Management practice	7	Team work good delivery	6	Timetabling Too fast
X. Tourism policy and Practice	7	Motivation to critical thinking Educational Trips	6	Can be more linked to hospitality

A) The results of the first CEQ survey

The first CEQ survey shows that 94 out of the 175 respondents (54%) commented on best aspects of the block delivery while 74 (42%) commented on aspects of the block teaching that need improvement. Through thematic analysis the responses were grouped into eight categories: 1) Block deliver (course design); 2) Teachers expertise and teaching style; 3) Assessment and feedback; 4) Personal and professional development; 5) Supporting resources (learning materials, guided learning, communication, study environment); 6) Timetabling; 7) practicality and employability; and 8) Collaborative learning.

The analysis of data showed that personal and professional development, teachers' expertise and their teaching styles; and the design of block delivery itself were the top three best aspects of block delivery, each with comments from over 20% of respondents. The next two aspects that were commented fair number of respondents were collaborative learning (14%) and supporting resources (9%)

On the other hand, the respondents also found aspects of the block teaching that need improvement, among which the top four aspects were assessment and feedback (26%), supporting resources (23%) teacher's expertise and teaching style (20%), and practicality and employability (15%).

B) The qualitative feedback from both the unit survey and the CEQ survey

As mentioned earlier, about 50% of the respondents made additional comments on the new PG programmes, either positive or negative, or both. For comparison, these are presented in Table 3 below:

Table 3 Qualitative feedback form the students

<i>Category</i>	<i>Positive comments</i>	<i>Negative comments</i>
Block delivery (course design)	<p>"Block teaching - smart learning experience."</p> <p>"Block teaching encourages both individualism and team work."</p> <p>"Weeks 1 and 4 [heavy teaching weeks] are tiring. It is a lot to take in."</p> <p>"Well, I must confess, it has been a wonderful experience. Never a dull moment."</p> <p>"Block teaching is very good, it gives you the opportunity to concentrate on one unit at a time."</p> <p>"One unit at a time - creative and dedicated lecturers bring and share interesting materials, ideas and encourage us to think critically."</p>	<p>"The course needs more options in terms of unit choices."</p> <p>"Too many things [covered] in a lecture."</p> <p>"Too little learning time. If you have the wrong idea then there is no time to rectify."</p> <p>"I do not like the fact that some units have two tutors teaching the same thing, and sometimes their instructions collide."</p>
Teachers expertise and teaching style	<p>"Interaction with lecturers"</p> <p>"The way of teaching is really supportive and encouraging."</p> <p>"Some exceptional lecturers really motivate us to be the best that we can be."</p>	<p>"Some lecturers are more enthusiastic than others."</p> <p>"Detailed lecturing is needed."</p> <p>"Too many lecturers on some blocks."</p>
Assessment and feedback;	<p>"Very practical assignments."</p> <p>"Challenging assignments and interactive teaching."</p> <p>"More time to do the assignment would be good."</p> <p>"Feedback given at the end of each assignment helps me improve my work."</p>	<p>"More explanation on assignment."</p> <p>"Do not have enough time to do the assignment."</p> <p>"The staff should spend more time on analysing the assignment and giving more feedback."</p>
Personal and professional development	<p>"Opportunities for practical learning are great."</p> <p>"This programme develops many skills and mad me confident."</p> <p>"The industry visits and guest lectures have opened my eyes to the potentialities. The course is very useful to my future career"</p> <p>"Guided learning resources have had a significant impact on my learning."</p>	<p>"[Need to develop] analytical and problem solving skills."</p> <p>"Courses are not only about assessment but also for our future career [development]."</p> <p>"Bring more guest lecturers in the with expertise in the field of project management."</p>
Supporting resources		
Timetabling;		<p>"The timetable was confusing."</p> <p>"The timetable changed in block 2." [because of the unpredictable number of students]</p> <p>"More weeks in each unit [would be desirable], 6 weeks are not enough."</p>
Practicality and employability	<p>"Practical approach rather than mugging up theories."</p> <p>"The practical aspect helps to put theory into practice."</p>	<p>"Practical approach on the employability issues."</p> <p>"[The course] needs more practice related to theories."</p> <p>"Better connection between theory and reality."</p> <p>"Give more case studies, not assessment as staff always teach how to write assignment."</p> <p>"The accessibility of tutors and being able to contact them during office hours is difficult."</p>
Collaborative learning	<p>"Very good relationship between tutors and students."</p> <p>"Interactive lectures, passionate tutors, guided learning."</p>	

N. B. The comments in *italics* are from the unit surveys, and the comments in not in italics are from the CEQ surveys.

Despite the diversity of topics, tutors and deliveries, there is an unexpected consistency in comments received and Table 3 provide some typical examples. On the positive side: critical thinking, good understanding, good relationships with tutors and interesting deliveries, which are consistent with research on flipped classroom (Kurtz et al., 2014) or blended learning (Unger et al., 2013). On the side that needs improvements the comments were mostly about: **a.** the intensity of the blocks indicating that for students the delivery mode was indeed novel and quite challenging to adjust to; **b.** perceptions of timetabling issues; **c.** perceived lack of time to do assignments properly.

It is a bit like marmite – love it or hate it. Students clearly find that the block teaching delivery is intense but fun and the practical learning is really appreciated. The actual learning time for assessments is the same in block delivery as it was for the previous delivery but the perception of reduced time is very real to the students. The timetable is static for a block but will change as students move from block to block which is different to their prior experiences where they typically had a timetable for the year. Whilst all this is covered during induction some students fail to attend the full induction process. This is an aspect that the team will consider exploring in detail to examine the extent to which attendance at induction is an explanatory factor in student performance and engagement. However, it is clear that more effort needs to be invested in managing student expectations.

C) Feedback from the staff focus group

The staff focus group that followed the delivery of the first block uncovered revealed some interesting insights:

Table 4: Examples of staff feedback from focus group

<i>Positive feedback</i>	<i>Negative feedback</i>
<p><i>“Student engagement has improved.”</i></p> <p><i>“Much better interaction with students, we get to know them better and form good relationships.”</i></p> <p><i>“Bring students together into larger cohorts has enriched the experience for everyone.”</i></p> <p><i>“Skills gaps (such as numeracy) surface more quickly and can be addressed.”</i></p>	<p><i>“Students who miss induction struggle to catch up.”</i></p> <p><i>“I worry that the new students are getting left behind.”</i></p> <p><i>“Skills development (e.g. critical writing) needs a coordinated course level approach.”</i></p> <p><i>“Frictions amongst students can escalate quickly when there are less gaps in the learning experience for them to cool down.”</i></p> <p><i>“[It was] challenging and demanding to deliver the first time.”</i></p> <p><i>“Tough to teach a block if you have UG teaching at</i></p>

<p><i>“Blended learning has resulted in a greater variety of learning experience, and has also enriched the staff experience.”</i></p> <p><i>“I was reluctant to blocks but the change has made me a better teacher.”</i></p>	<p><i>the same time.”</i></p> <p><i>“Team teaching is a challenge.It’s nightmare when someone doesn’t pull their weight –the Head of Department needs to step in.”</i></p> <p><i>“Cross departmental teaching teams are difficult to coordinate.”</i></p> <p><i>“Keeping complex team teaching on the road is really hard.”</i></p>
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The staff have identified the pivotal role that the induction process plays in ensuring that students ‘hit the ground running’ and succeed in the block delivery model. This was most noticeable in staff perceiving that students engaged and performed better in the second half of the unit. As successive blocks have recruited the faculty is now in the position of having students in their first, second, third and fourth block of study across all units and the use of peer learning could be a focus of future activity in response to this challenge,

The staff acknowledge that the new block delivery structure has dramatically improved the complexity of the PG provision as evidenced by the fact that they would not choose to return to the old system. The learning experience has also improved for both staff and students with greater variety and scope to include innovative employability aspects in the provision with guest speakers and visits etc, However, there are still challenges to overcome associated with transparently managing the fluctuating cohorts of students and administrative systems need to flex accordingly to support this. The main challenges in delivery are linked with team teaching and the merging of block teaching at PG level with more traditional delivery patterns at UG. Staff development was embedded in the implementation plan for the new delivery as both a faculty wide development and with core teams of staff as they prepare for each block of delivery. More focussed staff development is now needed in the area of team teaching in particular and consider the organisational structures that support the activity.

Future staff focus groups will explore the issues in more depth. with a focus on how staff manage the dynamic of having mixed cohorts of students in their 1st, 2nd 3rd or 4th block. At the time of writing, staff who taught the first block are preparing to teach the unit again; this provides a valuable opportunity to evaluate how they are adapting their practice based on their experience in block teaching delivery.

5. Conclusions

This is a work in progress and the current paper represents only the first chapter on a longitudinal study. The team believes that block delivery is different from more traditional

postgraduate deliveries and that the data so far indicate that the experience is of a high quality and translates to high levels of engagement and performance for staff and students. Student performance and satisfaction have improved even though the external examiners think assessments have got more challenging. The preliminary findings also indicate that there are certain things worth exploring such as students' perceptions of the assessment, the levels of engagement they should exhibit to perform well, developing the four tier induction process and strategic development of peer learning strategies.

The course team will conduct more detailed statistical analysis of the course experience questionnaires with a focus on learning preferences; and detailed staff evaluation with a focus on 'teacher' preferences. Then we will aim to further improve the delivery model,

The course team is confident that once the novelty of the block pedagogy wears off, the peer-to-peer activity coupled with the employability focused inductions will enhance our students' performance and learning experience. These early findings will be augmented by further periodic unit surveys and CEQ surveys on student course experience and learning, as well as student exit focus groups examining the whole learning journey.

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The CAMBRIA case: Learning through experience

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Abstract

Experiential learning contributes to the development of thought-related abilities, such as critical thinking and creative thinking. This article evinces the contribution of this theoretical and conceptual proposal through a specific experience with the CAMBRIA project, a solar electric vehicle built at Universidad EAFIT, that potentiated aspects related to multidisciplinary work amongst undergraduate students and, in turn, brought about pedagogical changes at the Institution. CAMBRIA opened a panorama for exploring new alternatives in the teaching-learning process and, through participation in non-simulated activities, led to the restatement of certain core aspects of the University's educational activities. An analysis of this topic also leads to the formulation of a learning and competency acquisition model. Finally, project results and conclusions are presented, which include elements derived from the proposed model and testimonies from some of the participating students, who were interviewed in depth.

Keywords: *Experiential learning; Critical thinking; Creative thinking.*

1. Introduction

Educational institutions focus their efforts on successfully adapting their academic programs to a world in constant transformation (Celuch & Slama, 1999), which implies conceptual and technological requirements that transcend current market demands (Class, 2011). This dynamic of change requires adopting pedagogical strategies that promote the appropriation of relevant skills for cultivating creativity, critical thinking and permanent learning in persons (Peters, 2015). CAMBRIA, a pioneering project from CREA, the experimentation, leadership and development center at Universidad EAFIT (Colombia) is part of an institutional plan that seeks new schemes and mechanisms for generating, transmitting and adopting knowledge. This initiative was conceived under experiential learning guidelines, and materialized through a solar electric vehicle, designed and manufactured over less than six months and with an approximate budget of 150,000 USD, with the goal of participating in the iLumen European Solar Challenge. This is a 24-hour long competition held on September 24 and 25 at the Zolder circuit in Belgium and in which 12 solar vehicles, along with 2 Teslas, underwent a unique endurance test. This article seeks to analyze the role of experiential learning in the acquisition of abilities and competencies associated with critical thinking and creative thinking, using CAMBRIA and its affiliated groups as a specific frame of reference.

2. Theoretical Framework

2.1. Critical Thinking

The topic of critical thinking has become of considerable theoretical and pedagogical interest (Bailin, Case, Coombs, & Daniels, 1999). This topic's spectrum transcends the educational field, with special attention being paid to it by companies, entities that understand the impact of understanding and managing the complexities associated with working environments (Hilton, 2008). Although the concept of critical thinking admits multiple positions (O'Neill & Dluhy, 1997), there is a certain degree of consensus regarding its constituent features, including purpose, motivation, and goal orientation. The literature highlights the importance of this topic for problem solving, inference formulation, probability calculation, and decision-making (Halpern, 1999). Critical thinking also demands identifying and defying assumptions, contextual analysis, and the ability to explore different courses of action (Brookfield, 1987). It deals with the capacity to evaluate situations in a disciplined manner, foreseeing the implications for any stakeholder groups involved therein (Yousefi & Mohammadi, 2016).

2.2. Creative Thinking

Creative thinking plays a fundamental role in overcoming obstacles in all environments (Marguc, Van Kleef, & Förster, 2015). Creativity helps to solve problems that cannot be solved from other points of view or under conditions that have not been analyzed previously (Stuhlfaut & Vanden Bergh, 2014). It deals with a process for generating ideas, a process of reinvention and redefinition that has the underlying goal of reaching novel and original solutions. Its relevance can be found in countless scientific, artistic, theoretical and practical contexts (Stokes, 2011). Despite the dissimilar findings when trying to explain the nature and origin of creative thought, and existing theoretical differences, it can be affirmed that creative thinking occurs, at least in individuals, in situations that require novel solutions (Mumford, Blair, Dailey, Leritz, & Osburn, 2006). Under this framework, and having in mind certain abilities and attributes which cannot be achieved under the traditional teaching models, experiential learning scenarios have demonstrated to be a successful trigger of the skills and characteristics associated with creative thinking. (Ayob, Hussain, Mustafa, & Shaarani, 2011)

2.3. Experiential Learning

The theoretical and conceptual proposal of experiential learning is founded on the contributions of developmental psychology, which asserts that knowledge is generated through the transformation of experience (Kolb, Boyatzis, & Mainemelis, 2002). According to Kolb (1984) experiential learning is composed of a spiral cycle involving concrete experience, reflection on experience, the creation of abstract concepts, and, out of this reflection, their application to new concepts. This approach is useful if one considers the supporting evidence for the role of experiential learning in the development of critical thought (Bigelow, 1991) and the dissimilar transformational effect of existing learning experiences (Bird, 2015).

Experiential learning contemplates a process through which knowledge is created through the transformation of experience, resulting from the combination of acquired experience and its evolution, emphasizing the potential of discovery in an individual's learning process (Kolb, 1984). Its impact on the development of multiple abilities inherent to workplace dynamics is highlighted (Bell, Kanar, & Kozlowski, 2008), as well as on the high levels of commitment achieved in students, who require more and more pedagogies that will capture their interest and desire to learn (Lovelace, Egger, & Dick, 2016). However, it must be pointed out that the thought-related competencies developed under experiential learning are highly contextual. This means that, unlike other abilities, such as athletic abilities, those related to thinking cannot be separated from an understanding of the nature and the purpose of the task to be performed (Bailin et al., 1999).

3. The Model

The following is a model that uses experiential learning to leverage the adoption of competencies linked to critical thinking and creative thinking. This proposal seeks to understand the way in which the tools for deploying experiential learning can contribute concretely to the development of faculties inherent to critical thinking and creative thinking.

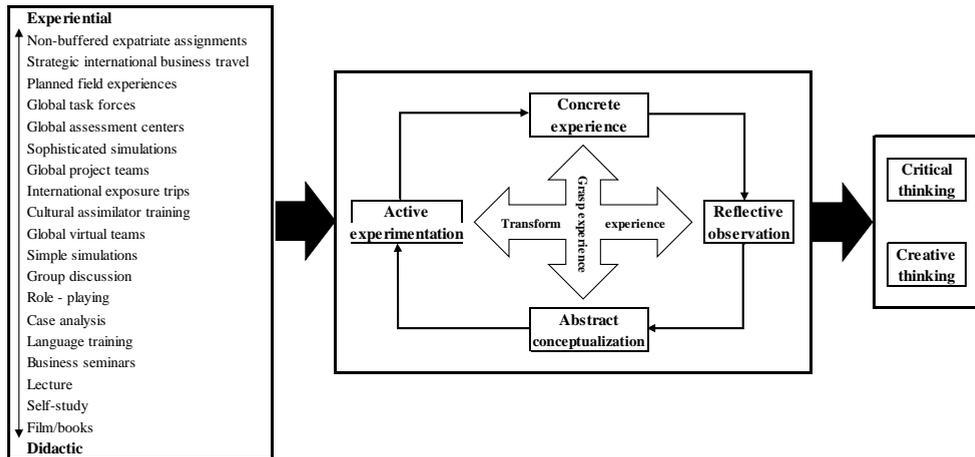


Figure 1. Experiential-critical thinking learning model. Prepared by the authors, taking from Bird (2015) and Kolb (1984)

The model contemplates an analysis of learning experiences through a continuous scale that allows locating activities according to their transformational power and the volume and quality of the feedback received from the source of knowledge (Oddou & Mendenhall, 2012). The use of the didactic-experiential continuum restricts the possibility of determining the potential impact of the experience, as it focuses exclusively on the pedagogical approach used, and leaves out reflexive observation, a critical component of the learning experience. To overcome this limitation, the links between the pedagogical scales of learning practices, experiential learning, critical thinking and creative thinking need to be analyzed. To do this, the proposals made by Kolb (1984) are turned to. The involvement of reflexive observation, abstract conceptualization, active experimentation and concrete experience emphasizes an ability to interpret and reinterpret events, always considering context and feedback, and therefore requires more from individuals than presence and mechanical repetition (Bennet & Salonen, 2007). This concludes the theoretical proposal, which provides an account of a binding sequential model between pedagogical practice, experiential learning, critical thinking and creative thinking.

4. The Experience

In May 2016, CAMBRIA was set up as a pioneering project for CREA, Universidad EAFIT's experimentation, leadership and development center. The idea arose out of an exhaustive analysis of the initiative's viability by several members of the Business School (dean, department heads, professors, students). It was structured with the purpose to develop complementary learning mechanisms which would promote the acquisition of competencies through integral initiatives under the guidelines contemplated in experiential learning. The team was put together after a series of invitations sent out to all students in the University's undergraduate programs, with a view to setting up a multidisciplinary group. 25 students from diverse schools (nine from Business, nine from Engineering, six from Humanities, and one from Sciences) participated. The technical leadership of this challenge was assumed by an MIT alumnus who is an expert in the manufacture of solar vehicles, and supported administrative and organizationally by the deans and five professors from the Institution's Business and Engineering Schools, who followed up functions linked to process design, budget planning and execution, investments and expenditures; activity and scheduling control and follow-up, and managed sponsors, press and dissemination. During execution, a weekly agenda of deliverables and committees was configured that served a double purpose: one, to validate compliance with scheduled activities, and two, to solve any accidents or unforeseen events that might arise along the way. Activities were performed over a period of 90 days, a record time for this type of project. A distant, seemingly impossible dream was achieved thanks to the commitment and passion of the CAMBRIA students, who defied all barriers and difficulties to finally participate in the iLumen European Solar Challenge.

5. Results

CAMBRIA's performance in terms of design, speed and innovation, surpassed all the team's expectations, including those of outside persons that witnessed the iLumen European Solar Challenge. But perhaps the most important achievements were made on the pedagogical and learning levels, both by the participants and by the institution. For the Business School, the preparation and execution of CAMBRIA represented an inflection point in its pedagogical activities, encouraging reflection around experiential learning and challenge-based learning activities, considering their curricular effect, in terms of competencies and skills, especially within a framework of critical and creative thinking, and it is suggested that these need to be strengthened to deal with non-simulated organizational challenges with high-impact implications.

In-depth interviews were carried out with five students participating in the CAMBRIA project, and with their testimonies they bore witness to the challenge's positive effect on

their lives, both academic and personal. CAMBRIA allowed them to experience what they had learned in the classroom in the real world, as it was a non-simulated space in which events that occurred had tangible consequences. Besides, the contrast between theory and practice together with the experience acquired, allowed students to analytically evaluate different alternative solutions to problems, contributing to their creative thinking (Mumford et al., 2006) and to improving their decision-making criteria by strengthening their critical thinking skills (Brookfield, 1987; Halpern, 1999; Yousefi & Mohammadi, 2016). The fact of learning by doing meant students had to find new approaches for managing difficult situations (Marguc et al., 2015), work in teams, perform in high-pressure situations, and value and manage resources and time. The students catalog CAMBRIA as an experience that changed their lives and made a mark on them. Some of those interviewed stated they had found themselves and had found a family in the other participants. All of them highlighted that the project's demands in terms of commitment and responsibility, heightened their own motivation and resilience (Marguc et al., 2015) and their capacity for adapting to new environments (Stokes, 2011). Table 1 presents some of the results achieved, classified into two dimensions: personal and academic. This learning process helped close the cycle proposed by Kolb, as it contemplated the stages of reflexive observation, abstract conceptualization, active experimentation, and concrete experience (Kolb, 1984).

Table 1. Dimensions of learning achieved

Academic	Personal	
Experiencing classroom learning in reality	Identity	Management of difficult situations
Comparing theory and practice	Social relations	Teamwork
Autonomous learning of new concepts	Motivation	Work under pressure
Multidisciplinarity	Resilience	Resource management

6. Conclusions

CAMBRIA can be considered a revolutionary, transformative initiative compared to traditional learning methods, a project framed by experiential learning that became an institutional landmark and opened the spectrum for the use of new complementary methodological proposals. The scheme for recruiting and involving participants in the project also represented a challenge in and of itself, as the students showed a strong interest in the experience, independently of the area of knowledge they were involved in and their academic performance. The impact of CAMBRIA evinces an evolution in learning-teaching methods towards non-stimulated environments that imply autonomous learning, informed decision-making, resource management, and real-life problem solving.

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Feedback-based Learning Through Online Feedback Systems in Higher Education

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Abstract

From scientific research it is known that feedback from students to lecturers can positively influence teaching and learning in higher education. This involves both responses concerning the quality of teaching and to students' learning process. In courses with a large number of students it is challenging to receive individual feedback from all students, using the traditional method of oral feedback. One possible way is to use online feedback-systems. Through this, all students have the opportunity to express their opinion, requests or problems concerning the lecture in anonymous way, at any time. Furthermore, it allows the results to be discussed together in class. The paper deals with the issue of student feedback in higher education and presents an online feedback-system and its integration into the teaching process. In addition, the paper shows some empirical based experiences made with the feedback-system in three courses in a German University of Applied Sciences. It becomes visible that feedback-systems have the potential to improve the quality of teaching and make learning more interactive and student-oriented.

Keywords: Student Feedback; Feedback-based Learning; Higher Education.

1. Introduction

It is known from scientific research that feedback plays a key role in learning success (Hattie & Timperley, 2007; Sambell, 2011). This is why many studies focus on giving feedback to students. Besides, also for the lecturer, it is important to receive feedback from students to both constantly improve the quality of teaching and to assess the current understanding of students (Bergstrom, Karahalios & Harris, 2011; Powney & Hall, 1998; Ghilay & Ghilay, 2015). In literature this kind of response is also called *Learner to Educator Feedback* or *Student Feedback* (Becker & Butler, 2011). However, especially in courses with a large number of students it is challenging to receive oral feedback from all participants. Bergstrom, Karahalios & Harris (2011) suggest that this is because students “often avoid volunteering information due to evaluation anxiety, a fear of being judged by others for making a mistake or being the focus of attention” (Bergstrom, Karahalios & Harris, 2011, p. 627). This is not only the case when giving feedback concerning the quality of teaching but also in giving feedback to the own learning process, for example understanding barriers. One possible way to solve this problem is to support the courses with online feedback-systems. They give students the opportunity to express feedback in an anonymous way, at any time. Results can be discussed together in class (Bergstrom, Karahalios & Harris, 2011). This type of teaching with online feedback-systems is also called *Feedback-based Learning* (FBL) (Ghilay & Ghilay, 2015). There are already empirical studies illustrating the efficiency of such a learning approach (Ghilay & Ghilay, 2015). In contrast, practical examples about how to implement feedback-systems in higher education are very rare in scientific literature. In the following, an online feedback-system and its integration in higher education will be presented.

2. Online-Systems for Students' Feedback

2.1. Background: Student Feedback

There is empirical evidence that student feedback can have positive influence on teaching and learning (Becker & Butler 2011; Bergstrom, Karahalios & Harris, 2011; Dwinell & Higbee, 1993; Jena & Chakraborty, 2014). For instance, asking for feedback shows students that their feelings and individual learning situations are taken seriously. Researchers already found out in 1993 that for students it is most important to know that their opinions are being heard (Dwinell & Higbee, 1993, p. 999). Furthermore, it is possible for lecturers to get an impression of students' problems and current understanding and thereby “making student's thinking visible” (Etkina, 2000, p. 595). This is one of the most important strengths of such an approach, since it enables lecturers to address mentioned problems or questions regarding a certain lesson. It thereby means that teaching can be

more adapted to individual learning situations, even in courses with a large amount of students. Besides, there is empirical evidence that feedback from students can also positively influence lecturer’s motivation and their engagement in teaching (Jena & Chakraborty, 2014) and through a structured feedback-system it is possible to stimulate students to reflect about their individual learning process (Lehmann, Söllner & Leimeister, 2015).

Naturally, there are many different ways to receive student feedback (Powney & Hall, 1998). A famous strategy is to use structured evaluations, especially at the end of the semester (Jena & Chakraborty, 2014; Coffey & Gibbs, 2001; Rindermann, 2001). An alternative is a continuous feedback during the entire semester (Etkina, 2000). This has the advantage that it is possible to react promptly and to immediately “work” with the gained insights. Besides, through online feedback-systems students can give feedback anonymously. Due to the fact that often only a few students ask questions in class (Bergstrom, Karahalios & Harris, 2011) it thereby offers the opportunity to ask questions without fearing negative consequences.

2.2. Feedback-Cycle

According to the feedback-cycle of Hounsell (2003), the process can be divided into six steps: 1) Clarify context and focus, 2) devise a feedback strategy, 3) gather feedback, 4) analyze and interpret the data, 5) agree on action and 6) implement changes (Hounsell, 2003, p. 210).

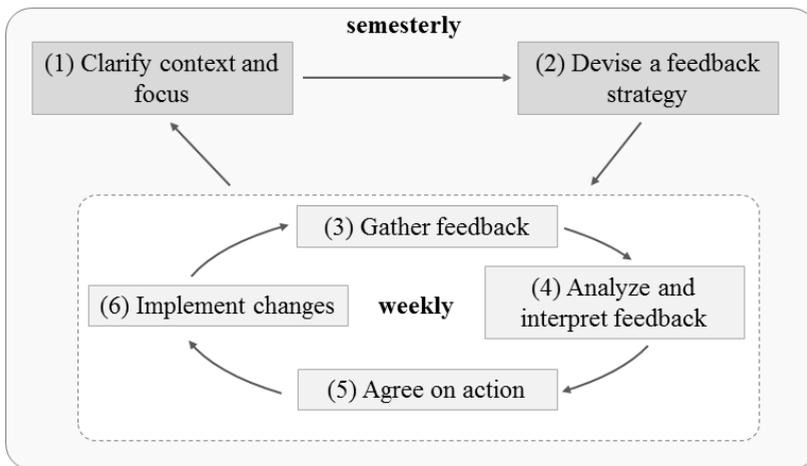


Figure 1. Adapted feedback-cycle inspired by Hounsell (2003)

This model, which was initially created for evaluation contexts, can also serve to implement online-feedback systems. To have the opportunity to compare answers of students during the semester, it is appropriate to use the same context and focus, as well as the same feedback strategy for the whole semester (step 1 and 2) and then weekly iterate through the feedback-cycle, especially step 3-6 (see Figure 1). That means that gathered feedback can be weekly analyzed and implemented in teaching.

2.3. Example

Online-systems for students' feedback can look quite different. In the following an example of a German University of Applied Sciences will be presented to show how questions can look like. The underlying goal of the teaching concept is to both acquire feedback concerning the quality of teaching and the situation of students in an open and anonymous way and to have the ability to adapt teaching to meet the needs of the students. Based on the specific context a feedback strategy was designed. An online-based open questionnaire was established in Moodle where students have the possibility to write comments weekly, to ask questions and to give feedback to the lesson at any time. As Müller (2007) suggests, a combination of qualitative and quantitative responses is fruitful for a rich feedback. This is why the feedback-system consists of two parts, open questions and closed items. Open questions could be voluntarily answered. Questions were, for example:

- How do you feel about the last lesson?
- Do you have any wishes concerning the lecture?
- Do you have any questions concerning the last lessons or problems you would like to discuss?

In addition, closed items (7-point scale) basically refer to the learning situation of students, which all students in the course had to answer weekly in order to have access to the task-sheets of the week. Items were, beside others:

- How difficult did you find the last lesson?
- How much time did you spend to perform tasks of the last lesson?
- How difficult did you find the contents of the last lesson?
- In case you would write your exam tomorrow: How would you pass?

The online-questionnaire containing the questions presented above was given to students after every lesson and the resulting feedback was analyzed promptly before the next lesson. All comments in open questions were collected. Besides, the results of open questions closed questions were analyzed and presented in diagrams. Based on the gained insights the lecturer decides how to react to the results in the next lesson, for example to prepare further learning material, give more explanations or to apply different teaching strategies. Each lecture starts with referring to the recent feedback, presenting the results and implementing

the actions that were planned before. For instance, the lecturer presents possible solutions, offers further learning material or follow-up explanations.

3. Experiences and Evaluation

The feedback-system was implemented in three different courses in a German University of Applied Sciences. All courses were held by the same lecturer and were about programming languages for first semester computer science students. Course I had 83 students and took place in winter semester 2014/15. Course II with 79 students took place in winter semester 2015/16 and course III with 80 students took place in winter semester 2016/17. In total 242 students participated in three course iterations.

3.1. Qualitative Feedback

Open-ended questions were on a voluntary basis. As could be seen in Table 1, the opportunity to give open feedback was used frequently by all semesters. The response was high; still it was different in the courses. The open answers can be divided into feedback concerning the quality of teaching and feedback concerning the individual learning situation. In total 267 responses were given in three courses.

Table 1: Amount of responses in open questions in all courses (I, II and III)

		I	II	III	Total
Feedback concerning the quality of teaching	Positive	37	44	25	143
	Negative	9	19	9	
Feedback concerning the individual learning situation	Hints	8	17	8	124
	Questions	27	13	12	
	Problems	3	34	2	
Total		84	127	56	267

Students' comments varied greatly. Most of the comments (143) refer to the quality of teaching. Open answers were for example "I really like the example you gave last lesson. NOW I understand!", or "Your explanation of polymorphism was too fast the last time!" Questions about the individual learning situation mainly refer to understanding problems and questions (in total 124). Students made examples with code, they asked simple understanding questions, for example "I still have some problems with inheritance and polymorphism". "Could you please explain the difference between getter and setter? Thanks!". Those hints, questions and problems were collected and discussed together in the next session.

3.2. Quantitative Feedback

Quantitative feedback gives insights how students feel about their learning process. Results can be presented to students weekly, for instance with diagrams. Moreover, trends became visible when analyzing the diagrams and relating certain teaching units to learning contents. For instance, it became obvious when comparing the third, fourth and fifth teaching unit of the three semesters, that there is a considerably increase in perceived difficulty of the learning contents (see Figure 2). This finding further strengthens the results gained from the qualitative remarks of the students for these specific units. Having the possibility to compare three different semesters, a lecturer is able to create more profound ideas for long-term changes in learning activities which can more precisely show their effect on specific learning contents. Therefore these changes have the potential to positively influence the student's perceived difficulty of learning contents in a positive way. It is worth mentioning that basic changes of learning activities should only be realized after observing at least three different semesters. The heterogeneity of the students requires this period of time and prevents lecturers from well-meant actionism.

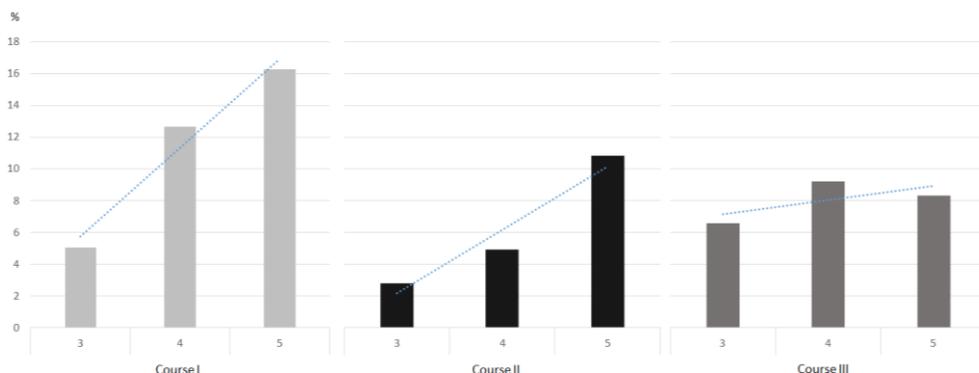


Figure 2. Feedback which indicates that difficulty is considered as high or very high. Regarding all courses (I, II and III) in three learning units (3, 4 and 5).

Nevertheless, collecting and comparing quantitative feedback data can serve as a valuable, non-exclusive, instrument in order to tackle students' problems.

3.3. Evaluation

To get an impression how students rate the feedback-system an open question at the end of the semester was added: "How do you feel about the course in total, including the feedback-system?" Interestingly, a few students (13%) stated that the feedback system had in their impression some negative aspects. For example, a student stated: "To be honest: To answer that questionnaire every week is annoying". Still, most of the students (78%) said that it helped a lot to have the opportunity to ask questions any time. A student wrote: "I appreciate that you discuss all the questions together in class. I learned a lot through it". And: "More lecturers should use such anonymous feedback!". This shows that students have different opinions about the feedback-system. Interestingly, several students stated that they are normally afraid of asking questions in the lesson and that the feedback-system helped them to express their opinion anonymously.

4. Conclusion and Outlook

Online feedback-systems enable to get weekly feedback from students and enables lecturers to discuss results in class. This has several positive effects: students get an anonymous space to communicate with the lecturer; the lecturer gets feedback and knows how students consider themselves regarding their learning progress. Based on this the lecturer can adapt teaching. Experiences in higher education courses lead to the assumption that anonymity plays an important role in students feeling free to ask questions and criticize without fearing negative consequences. One of the most important aspects is that lecturers can discuss feedback at the next possible opportunity and to discuss questions and problems in class, thereby closing the "feedback loop" (Keane, 2005, p. 12). However, it must be noted, that such a feedback-system cannot be seen as alternative for direct feedback and interaction in class. It must rather be seen as assistance for communication. In summary it can be said that for those lecturers with large amounts of students, online-feedback systems can help to improve communication and lead to better, more individualized teaching. This paper showed one possibility to use an online feedback-system and gave some insights into students' view about it. Still, further work must be done to prove the efficiency and the impact which online feedback-systems have on learning success.

Acknowledgments

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Student Evaluation of Teaching (SET): Clues on how to interpret written feedback

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Abstract

In this paper we present the results of a study covering 218 written comments submitted in the formal university SET questionnaire of two undergraduate physics lectures for engineering students. Concerning the SET-metrics, one of the lectures was rated as critical, while the other lecture had good results. The analysis is based on the praise and criticism framework elaborated by Hyland/Hyland (2001) for written feedback. Our findings, which also relate written feedback to quantitative variables and contrast the results between critical and good evaluations, provide a deeper insight for both, teachers and educational developers, on how to interpret written comments in a quality management process.

Keywords: *student evaluations of teaching; students' comments; content analysis; quality management; student voice; formative feedback.*

1. Introduction

The feedback from student evaluation of teaching (SET) is a major instrument to measure the degree of faculty achievements. SET is carried out with rating forms, online or paper, that students have to fill in at the end of the term. Typical items of the questionnaire include Likert-scale questions on the teacher performance, the provided material and the class organization (Marsh, 2007). Based on a defined metrics, those items are statistically compiled to measure the teacher's teaching effectiveness. The results of SET are often used to decide on tenure or promotion of the teacher (Kember et al., 2002). Another feature of SET, however, consists of providing feedback to the teacher (Yao&Grady, 2005). To support this formative purpose of the SET, the questionnaire often includes free-text questions, where students can comment on their personal experience in more detail.

Whereas the analysis of SET data mainly focuses on quantitative ratings, little is known about the impact of written feedback from free-text questions. Among the few studies dealing with written comments, Alhija&Fresko (2009) and Brockx et al. (2012) offer some valuable insight into quantitative aspects of free-text comments. Moreover, open-ended comments have been subject to linguistic analysis (Stewart, 2015) and were used for exploratory considerations (Hodges&Stanton, 2006; Stupans et al., 2016).

In this study we combine quantitative results together with lexical evidence in order to provide some interpretative hints, on how to link written comments to the overall questionnaire results.

2. Data and Coding

The data cover 218 written comments submitted in our formal university SET questionnaires. They result from two independent undergraduate physics lectures (table 1). According to the SET-metrics (based on Likert-scale questions) defined by the university, lecture A is regarded as a good lecture, whereas lecture B was identified as critical. Written comments are open-ended answers induced at the end of the questionnaire by the item *"Imagine that you are the lecturer teaching this course unit. What would you improve? What would you keep unchanged?"*. Their sole purpose is to provide feedback to the teacher and at ETH Zurich they are not relevant for the SET-metrics.

We based our coding scheme (figure 1) on the "Praise and Criticism" feedback points introduced by Hyland&Hyland (2001). Each feedback point is related to one of the 7 predefined content categories and identified either as critique, praise or suggestion. The categories have been selected according to the main themes of the preceding Likert-scale questions of the questionnaire. With an average of 55 words the comments turn out to be

rather extensive and almost all comments include a set of different feedback points (table 2).

	lecture A	lecture B	total
evaluation records	273	326	599
records with comments	88 (32%)	130 (40%)	218 (36%)
average comment word count	40	65	55
feedback points	158	265	423
overt criticism	23	72	95
overt praise	70	72	142
suggestions	65	121	186

Table 1. Student evaluations and written comments included in the study. Lectures A and B are independent physics introductory courses for undergraduate engineers.

Content Categories		
C		Content: i.e. syllabus, level of complexity, curriculum
L		Lecturing: i.e. teacher performance, slides, experiments
M		Material: i.e. script, notes, master solutions
A		Activities: i.e. clicker, exercises
S		Support: individual support, online and in class
O		Organization (of the course, of exercise classes)
I		Alignment: exercises – lecture – exam
Feedback Points		
teacher	t+	overt praise, e.g. <i>"The teacher was available for ..."</i> → Cat. S
	t–	overt criticism, e.g. <i>"The teacher copies his script ..."</i> → Cat. L
activity	a+	overt praise, e.g. <i>"Exercises helped to understand ..."</i> → Cat. I
	a–	overt criticism, e.g. <i>"The script was erroneous ..."</i> → Cat. M
suggestion	s+	supporting, e.g. <i>"Keep the clicker questions ..."</i> → Cat. A
	s–	Improving, e.g. <i>"Less quantum mechanics ..."</i> → Cat. C
Mitigation		
pairing		explicit combination of praise and criticism, e.g. <i>"... however ..."</i>
hedges		verbally softening feedback, i.e. <i>"sometimes ..."</i>
details		providing examples and/or explanations, e.g. <i>"... because ..."</i>

Figure 1. Coding scheme. A single comment mostly includes several feedback points.

In addition we distinguished praise and criticism to whether it addresses the teacher as a person or the activity of teaching. In order to specify the degree of politeness, we also codified mitigation strategies. Pairing occurs when praise and criticism are used in combination. Hedges refer to the lexical mitigation of any feedback and details were recorded when concrete examples or further details are mentioned to underpin the feedback.

Most of the comments are written in German, but English is used as well. Furthermore, the comments range from single keywords to complex sentences, while using emoticons and special characters. Relying on automated or semi-automated analysis tools, as used in other studies (Stupans et al., 2016; Zaitseva et al., 2013), turned out to be inapplicable. All comments were hand-coded and double-checked for reliability.

comment	t+	t-	a+	a-	s+	s-	mitig.
Many errors in the script! Clicker questions are helpful and make the somehow dry lecture less monotonous.			A	M L			pairing hedges

Table 2. Example coding of a comment (3 feedback points).

3. Results and discussion

3.1 Critical lectures tend to entail more written feedback.

A total of 423 feedback points could be identified, 158 for lecture A and 265 for lecture B. This results in an average of 1.8 feedback points per comment for lecture A and an average of 2.0 feedback points for lecture B. The overall feedback for the critical lecture B, thus, was significantly more extensive.

3.2 Overt criticism is less frequent in good lectures.

In lecture A, overt praise (t+, a+) (n=70) occurred three times as often as overt criticism (t-, a-) (n=23). In contrast, for lecture B the occurrence of overt praise and overt criticism was identical (n=72).

3.3 Written Feedback addressing the teacher as a person is primarily positive.

Overt praise referencing the teacher (t+) could be identified in both lectures (A: n=31, B: n=26). Overt criticism (t-) only occurred 4 times in lecture B. Those instances, however, were heavily mitigated. Otherwise they would have classified for offensive comments. Stewart (2015) showed evidence that the praising tendency is generally directed to the teacher's person (t+) and criticism to the product of the teacher's actions (a-). E.g. "The teacher was highly motivated" vs. "The lecture was boring". We could only support these findings for the category L.

3.4 For critical lectures, students tend to provide more negative than positive feedback.

In lecture A the occurrence of positive feedback points (t+, a+, s+) (n=82) and of negative feedback points (t-, a-, s-) (n=76) was nearly identical. In lecture B, however, we identified almost twice as much negative feedback points (n=175) than positive ones (n=90).

3.5 Negative feedback is forthright and mostly lacks lexical mitigation.

Lexical mitigation (pairing, hedges) was used extremely sparse. Argumentative mitigation (details) occurred in both lectures with a clear peak in lecture B (table 3). Some of this additional information was helpful for further improvements of the lecture.

	lecture A	lecture B
pairing	17 (19%)	21 (16%)
hedges	7 (8%)	12 (9%)
details	42 (48%)	84 (65%)

Table 3. Distribution of mitigation strategies

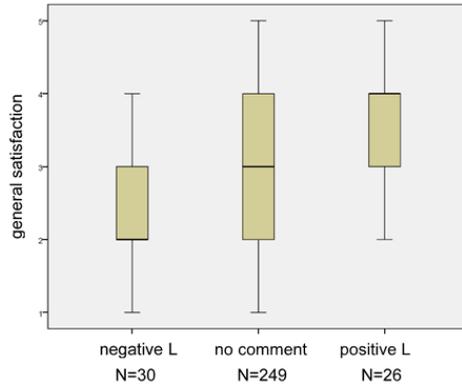
3.6 Written feedback can be biased, i.e. positive and negative feedback does not echo the general results of the evaluation.

Are comments biased? We conducted a one-way ANOVA to assess feedback for category L on the values of the SET-variable “general satisfaction” (table 4). Evaluation records were divided into one of the three subpopulations: “positive L”, “negative L”, “no comment”. Only for the critical lecture B, the SET-value differed statistically significant for the three subpopulations (figure 2). The SET-value decreased from “positive L” (3.6) to “no comment” (3.0) and further to “negative L” (2.3). For lecture A, however, the SET mean values of all subpopulations remained nearly unchanged.

lecture	SET	t+	t-	a+	a-	s+	s-	$\Sigma_{(+)}$	$\Sigma_{(-)}$	$\Sigma_{(tot)}$
A	3,7	30	0	14	5	7	15	51	20	142
B	2,9	17	4	18	10	9	34	44	48	184

SET is the mean value of the general satisfaction expressed by a 5-scale Likert question (1=“very unsatisfactory”, 5=“very satisfactory”). It is the key variable in the SET-metrics for quality management.

Table 4. Distribution of feedback points related to the category L (lecturing) in both lectures.



21 out of 326 records were omitted because they had pos. L together with neg. L, or they were missing a SET value.

Figure 2. Distribution of the SET-value for lecture B according to the three subpopulations (SPSS Boxplots).

4. Conclusion

Often lecturers feel confused and disappointed when reading students' comments, especially negative ones (Hodges&Stanton, 2007). With our study we offer a framework to interpret comments in the broader context of the evaluation results. Comparing comments from critical and good evaluations turned out to be extremely helpful. The fact that even good evaluations show a considerable number of critical feedback points was surprising. Identifying a possible bias in critical evaluations was another revealing finding. Even though the same problem is addressed in several independent comments, this does not a priori point to a major deficiency. Further data will be needed to support our results and we are planning to pursue the study with additional evaluation data sets.

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Introducing a Cross-Course Teaching Innovation to Enhance Group Project Performance

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Abstract

Marketing educators and students recognize the benefits derived from group assignments. Nonetheless, serious problems that occur frequently in student groups are diminished effort by some free-riding team members or disassociation from the group by lone wolf team members. In a highly innovative manner, the American Marketing Association's integrated marketing plan international competition was concurrently adopted by Principles of Marketing, Marketing Research and Advanced Advertising courses in an attempt to leverage the many benefits of team projects while minimizing their drawbacks. Empirical evidence suggests that group performance may be enhanced when lone wolf group members who possess a greater level of expertise to that of their peers are present.

Keywords: *lone wolf students; free riders; group project performance*

1. Introduction

Anecdotal evidence suggests that many of the marketing principles learned in the Principles of Marketing course are forgotten before students enroll in subsequent courses such as Consumer Behavior, Promotional Strategy, International Marketing, Marketing Research and Marketing Capstone. By introducing a comprehensive integrated marketing plan into the course, it is hoped that by applying these principles, students will retain their knowledge of them for a longer period of time.

2. Literature Review

2.1 Benefits of Group Assignments

Without question, marketing educators recognize the benefits derived from group assignments (Williams et al. 1991). First and foremost, they help to achieve the learning objectives in a marketing course (Henke et al. 1988). Moreover, past research in the education field suggests important advantages to group assignments that are perhaps less widely appreciated (Williams et al. 1991). Past research suggests that there exist a broad range of benefits for students participating in theoretical student-led group projects for real companies (e.g., Dommeyer 1986; Hansen 2006; Henke 1985; Henke et al. 1988; Parsons and Lepkowska-White 2009; Slavin 1990; Williams et al. 1991). For instance, they provide students with comprehensive, realistic experiences in marketing, and can develop other essentials of the workplace such as communication skills (Williams et al. 1991). Because they are oriented to marketing careers, group projects motivate students more effectively than individual assignments (Williams et al. 1991). They also give students the opportunity to experience the full complexity of marketing problems (Henke 1985; Henke et al., 1988).

Students in both theoretical and client sponsored group projects found them to be challenging, effective, practical, and intense; to build more interest in the course; and to help them apply the concepts studied in class to real life situations while giving them hands on experience and granting them an ability to see what they have learned (Parsons and Lepkowska-White 2009).

2.2 Challenges of Group Assignments

Notwithstanding the value of group assignments in marketing education, they can present significant drawbacks (Strong 1988). A serious problem that occurs frequently in student groups is diminished effort by some free-riding members (e.g., Abernethy and Lett 2005; Beard et al. 1989; Bosley 1990; Dommeyer 2007, 2012; Latane, Williams and Harkins 1979; Strong and Anderson 1990; Tyagi 2010) or disassociation from the group by “lone wolf” team members (Barr et al. 2005; Dixon et al. 2003). Finally, team projects frequently fail to provide the intended learning experience for a variety of reasons, among them

students' lack of effective interpersonal and small group skills, which leads to counterproductive group conflict (Forman and Katsky 1986; Johnson and Johnson 1987; Kohn 1986).

3. Teaching Innovation

In order to take advantage of the numerous benefits offered by group projects while attempting to avoid the aforementioned difficulties faced by students and faculty of working with actual clients, in a highly innovative manner, the American Marketing Association's integrated marketing plan international competition for eBay was concurrently adopted by principles of marketing, marketing research and advanced advertising courses in an attempt to leverage the many benefits of team projects while minimizing their drawbacks. The semester long group project in the three courses helped students gain factual knowledge about marketing such as terminology, classifications, methods, and trends; learn to apply the course material; and develop specific skills, competencies, and points of view needed by professionals in the field of marketing management.

The Principles of Marketing course helped students understand fundamental marketing concepts, theories, and principles with respect to external and internal environmental forces; understand fundamental marketing concepts, theories, and principles with respect to market and buyer behavior; understand fundamental marketing concepts, theories, and principles with respect to product (goods, services and ideas), distribution, pricing, and promotion decisions; recognize ethical problems related to marketing activities; and identify the major components of the environment for international marketing and describe various methods and strategies for entering foreign markets.

The Marketing Research course was designed to study research methodology and its application to the solution of marketing problems. Procedures and analytical tools were examined. This course familiarized students with the role of marketing research, designing research studies, measurement, sampling and statistical theory, and analysis and reporting. Upon successful completion of the Marketing Research course, the students were able to create a survey, demonstrating both an ability to construct items and assess validity; analyze data, demonstrating both an ability to understand and apply statistical tools; conduct a focus group, demonstrating both an ability to moderate and conduct a focus group; report research results, demonstrating both an ability to present a written and oral research report; and understand fundamentals about experimental design, demonstrating both an understanding of testing and demonstrating causality.

The Advanced Advertising course familiarized students with the role of advertising as an activity in a firm's marketing mix, the organization and process of advertising activity, advertising media, advertising campaigns, advertising methods in major media, advertising

research, cost analysis, and ethics-related issues. It was an advanced course that imparted a breadth of knowledge as well as a specialized depth of knowledge. In addition, the course introduced the students to four major parts of advertising: the process of advertising, the planning of advertising, preparing the advertising message, and placing the advertising message. The course was focused on the attainment of skills necessary for students to advance in their professional lives. These skills included creativity, critical thinking and the evaluation and creation of effective advertising communications, among others.

Finally, all three courses aim to help the students gain progress toward achieving the four undergraduate learning goals. First, students will build on the liberal arts core to demonstrate an ability to think critically and make business decisions that appreciate the need to balance the often conflicting demands of the marketplace, the global environment and society. Second, students will communicate effectively, using technology when appropriate. Third, students will demonstrate ongoing development of and strengthened skills in interpersonal relationships and teamwork. Fourth, students will understand the importance of behaving ethically in their professional lives.

The American Marketing Association provides a comprehensive competition guide, which outlines the deliverables expected from the students, along with several financial summaries of vitaminwater's performance in sales and market share, which avoided the problem of incomplete financial information often faced in client-sponsored projects (Parsons and Lepkowska-White 2009). From this project, students learned how to use secondary market research to perform a situation analysis; to conduct primary marketing research; to segment a market, identify a proper target market and position its brand toward that target market; devise a marketing strategy and tactics; and to propose how they would measure and evaluate their integrated marketing plan. The students were given a \$10 million budget to market eBay in the U.S. over a 16-month period beginning September 2016 and they were required to provide a 16-month sales forecast for their marketing strategy along with an additional four years of sales projections based on a continuation of their strategy while documenting their assumptions.

To a large extent, however, the problem of inequitable contributions was solved with a grading system that gave appropriate weight to individual contributions, as well as to the group's achievement (Williams et al. 1991). In doing so, it satisfied the necessity for individual accountability (Williams et al. 1991). To ensure students' achievement (based on course objectives), the reward structure motivated students to engage in effective group processes as well as to produce a quality product (Williams et al. 1991). The team assignment combined individual accountability with a group goal (Johnson and Johnson 1986; Slavin 1990; Webb 1982). The team assignment was an interdependent task, a cooperative goal that a student was able to achieve only insofar as the group achieved its goal (Williams et al. 1991). Such a structure provided an incentive for students to help their

fellow students learn, even to bring the slower ones along, and was the key to making the group project a fully cooperative learning experience (Williams et al. 1991). Students' individual achievement was monitored through numerous student meetings the professor both in class and out of class (Williams et al. 1991; Larson and LaFasto 1989). These meetings took place both on an individual basis and a functional team basis with students acting as account executives, publicists, media planners, researchers, artists and copy writers. Meeting minutes (Bogert and Butt 1990; Larson and LaFasto 1989), individual logs (Goldstein and Malone 1984; Nezlek et al. 1983) as well as mid-term and end of term peer evaluations (Williams et al. 1991; Darian 1988; Dommeyer 1986) accompanied by confidential memos (Williams et al. 1991) were collected from the students. In addition, the professor reserved the right to "fire" a student from the group at the mid-term if a student's peer evaluations indicated excessive free riding (Abernethy and Lett 2005).

4. Results

Consistent with previous research regarding the academic benefit of using American Marketing Association competitions (Aurand et al. 2012), the project did indeed encourage team members to help each other learn (Williams et al. 1991) both inside and outside of class. By spending over 100 hours per person on the project outside of class, 196 students (75 males and 121 females) on 23 teams exhibited extraordinary depth of thought and mastery of course content by applying over 100 terms from their textbook in their final projects. The top-ranked team was comprised of one senior female student enrolled in Advanced Advertising and Marketing Research concurrently as well as six freshman students (3 males and 3 females) enrolled in Principles of Marketing and a female sophomore mentor who had completed the project as a freshman. Competing against over 100 other universities from around the world, this team placed 10th overall as a semifinalist and surpassed teams from highly ranked universities such as Carnegie Mellon University, Indiana University, University of Georgia, University of Maryland, University of Texas at Austin, and University of Washington to name a few.

The students' learning is also evidenced by satisfactory performance on their chapter quizzes and final exam. Given that lectures were replaced with in-class exercises related to the project, this is an important point. Specifically, on the final exam, the students correctly answered 60% of the 30 questions that the northeastern liberal arts college has used for its AACSB Assurance of Learning assessment. While this is below the 70% answered correctly by students in other lecture-based principles of marketing classes in previous years, this is an acceptable outcome considering that students individually spent between a required minimum of 100 hours on the project. Another interesting finding is that the students performed consistently well on the most difficult questions offered by the Kotler and Armstrong (2016) test bank.

Drawbacks to this method include lower performance on the aforementioned common final exam questions as well as lower student satisfaction with the course as evidenced by the students' comments. Overall, these findings are consistent with the results of Bacon (2005), which indicated that students in a consumer behavior course learned less of the project-related content (measured with multiple choice and short answer questions) than did students who completed a shortened version of the project individually.

5. Conclusion

Marketing educators and students recognize the benefits derived from group assignments. Nonetheless, serious problems that occur frequently in student groups are diminished effort by some free-riding team members or disassociation from the group by lone wolf team members. In a highly innovative manner, the American Marketing Association's integrated marketing plan international competition was concurrently adopted by Principles of Marketing, Marketing Research and Advanced Advertising courses in an attempt to leverage the many benefits of team projects while minimizing their drawbacks. Empirical evidence suggests that group performance may be enhanced when lone wolf group members who possess a greater level of expertise to that of their peers are present.

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Makerspaces in Higher Education: the UR-Maker experience at the University of La Rioja

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Abstract

Nowadays, in addition to the expected technical knowledge, labor markets demand engineers with personal, interpersonal and system building skills, according to the CDIO (Conceive-Design-Implement-Operate) syllabus. But the current higher education systems are mostly teaching theoretical concepts rather than practical or applied cases. Makerspaces could become a bridge between universities and industry, particularly in STEM (Science, Technology, Engineering, and Math) careers. Makerspaces, also known as hackerspaces, hack labs, and fab labs, are open-access spaces where tools, machines and knowledge are shared with the purpose of implementing an idea. This communication evaluates the current status of the makerspaces at the world's top 10 universities in engineering and three of the most well-known Spanish ones, as well as the new campus makerspace created at the University of La Rioja. All the information was collected from universities' websites. Most of these reviewed universities have created outstanding makerspaces generally for the entire academic community. The Spanish 'Maker UPV' has been exceptionally successful promoting activities and projects in spite of the lack of resources reported. Lastly, the implementation of a new makerspace at the University of La Rioja (UR-Maker) is described with information about its organization, funding sources and activities already performed. This experience can represent an attractive guide for the academic community as other universities can explore the creation of new makerspaces on their own campus.

Keywords: *Makerspace; higher education; hands-on; PBL; engineering degrees.*

1. Introduction

According to the recognized conceive-design-implement-operate (CDIO) syllabus (Crowley, 2002), graduating students in engineering must achieve personal and professional attributes apart from technical knowledge. These competences will facilitate students to enter the working world and evolve in their future working lives. The current educational system is, however, primarily built on theoretical concepts rather than on real cases (Barrett et al., 2015). In this sense, project based learning (PBL) offers a way to promote this students' active learning approach by using realistic and applied projects that introduce practical work into the curriculum (Gary, 2015). Nevertheless, the definition of the appropriate learning environment is not an easy task, hindering the inclusion of significant PBL experiences into engineering education (Graham, 2010). A makerspace could become this suitable learning environment needed. Makerspaces are physical open-access spaces where a community shares tools, machines, and knowledge to give shape and life to an idea. Design, modify, build, test or repair are usual activities performed in the makerspaces. As a result, makerspaces could become a strategic element towards the inclusion of autonomous and social learning, developing the creativity competence through divergent thinking and innovation (Liu and Schönwetter, 2004; Thompson and Lordan, 1999). The New Media Consortium (NMC) Horizon Report: 2015 (Johnson et al., 2015) highlighted the importance of makerspaces within the higher education context and forecast deadline to achieve widespread adoption in two or three years. Neil Gershenfield was one of the pioneers on this kind of learning environment creating the first FabLab at the Massachusetts Institute of Technology (MIT) in 2001 (Walter-Herrmann and Büching, 2013). The idea behind the makerspaces has grown one on one with the Do It Yourself (DIY) movement, an open-source philosophy that intends to democratize the technology becoming accessible to everyone (Hatch, 2013). Aware of its importance, some of the most prestigious US universities (according to the QS World University Ranking (Rankings, 2016)) have joint efforts under the Higher Education Makerspaces Initiative (HEMI) (HEMI, 2017) to promote, develop and share the best practices in academic makerspaces. Contrary to the common thinking, and the data extracted from makerspaces at the US universities, a reduced budget is enough to start a makerspace in a university campus. Through their experiences, the authors demonstrate that a new makerspace requires minimum financial and human effort. This could be a useful guideline for other universities to explore the creation of new makerspaces on their own campus.

This communication evaluates makerspaces created by the ten top-rated worldwide engineering universities and three makerspaces at well-known Spanish universities. Moreover, authors detail their own experiences during the creation of a new makerspace at the Universidad de La Rioja.

2. Makerspaces in higher education. Current status

The methodology applied to search and organize the information about university makerspaces followed the work of (Barrett et al., 2015), in which the top 100 universities in the United States were evaluated. Another valuable reference for the methodology presented herein comes from a recent work that reviewed a total of 43 Australian universities (Wong and Partridge, 2016). Importantly, our communication makes no distinction between the different terms associated to a makerspace, such as hackerspace, hack lab, or fab lab. It is assumed that all of them represent a place for informal, hands-on learning. According to the QS World University Ranking (Rankings, 2016) in the “Engineering - Mechanical, Aeronautical & Manufacturing” subject, the world’s top 10 universities are (Table 1): N°1. MIT, N°2. Stanford University (StfU), N°3. University of Cambridge (UCm), N°4. University of California-Berkeley (UCB), N°5. Imperial College London (ICL), N°6. University of Michigan (UMch), N°7 Harvard University (HvdU), N°8. National University of Singapur (NUS), N°9. University of Oxford (UOxf) and N°10. Georgia Institute of Technology (GIT). Concerning the Spanish makerspaces, the top 3 Spanish engineering universities were selected for this study: N°82. Universidad Politécnica de Cataluña (UPC), N°130. Universidad Politécnica de Madrid (UPM) and N°160. Universidad Politécnica de Valencia (UPV).

Ranking		Makerspace Name.	Website
N°1	MIT	‘MakerWorks’	http://makerworks.mit.edu/
N°2	StfU	‘Stanford Production Realization Lab’	https://productrealization.stanford.edu/events/meet-the-makers-student-work-fall-2015
N°3	UCm	‘Dyson Centre for Engineering Design’	http://www.dysoncentre.eng.cam.ac.uk/
N°4	UCB	‘SuperNode’	https://supernode.berkeley.edu/
N°5	ICL	‘Imperial College Advanced Hackspace’	http://www.imperial.ac.uk/advanced-hackspace
N°6	UMch	‘Wilson Student Team Project Center’	http://teamprojects.engin.umich.edu/
N°7	HvdU	‘i-lab’	https://i-lab.harvard.edu/
N°8	NUS	‘Makerspace/FabLab’	http://makerspace.sp.edu.sg/f
N°9	UOxf	‘Radcliffe Science Library’	http://www.bodleian.ox.ac.uk/science/use/3d-printing
N°10	GIT	‘Invention Studio’	http://inventionstudio.gatech.edu/
N°82	UPC	‘FabLab Terrassa’	https://www.eet.upc.edu/curs-actual/activitats-i-beques/fablab-terrassa?set_language=es
N°130	UPM	‘FabLab UPM’	http://colaboratorio.eu/Public_html/FabLab_UPM/
N°160	UPV	‘Makers UPV’	https://makersupv.com/

Table 1. Websites of the makerspaces at the top 10 universities worldwide and the makerspaces at the top 3 Spanish universities.

The compiled information about the accessibility of every makerspace, payments, staff involved and equipment available is listed in Table 2.

	MIT	StfU	UCm	UCB	ICL	UMch	HvdU	NUS	UOxf	GIT	UPC	UPM	UPV
ACCESS													
Engineering students only	X		X										
All University community		X		X	X	X	X	X	X	X	X	X	X
External access											X	X	
PAYMENT													
Free	X		X	X	X	X	X	X	X	X			X
Pay for membership		X									X	X	
Pay/bring material	X	X	X	X	X	X	X	X	X	X	X	X	X
STAFF													
Student Run	X			X						X			X
Faculty Run		X	X		X	X	X	X					
Specific Staff		X	X		X	X	X	X	X		X	X	
EQUIPMENT													
3D printer	X	X	X	X	X	X	X	X	X	X	X	X	X
Laser cutter	X	X	X		X	X				X	X	X	
3D scanner		X			X	X			X	X	X	X	
Wood shop	X	X	X		X	X				X	X	X	
Metal shop	X	X	X		X	X				X	X	X	
Electronics	X	X	X	X	X	X	X	X		X	X	X	X
Computer	X	X	X	X	X	X	X	X	X	X	X	X	X
Photography booth	X	X			X		X	X			X	X	

Table 2. Makerspaces information regarding accessibility, payments, staff and equipment.

3. Results and Discussion

This communication collected public information about makerspaces from the website of the 13 universities selected. We assume that this may generate some misinterpretation or missing information concerning the current status of the makerspaces evaluated. Future studies in this aspect should explore deeper by carrying out some interviews or visits to verify the published information. In concordance with (Barrett et al., 2015) and (Wong and Partridge, 2016) observations, we encountered a wide variety of makerspaces at the 13 schools studied. These US universities have indeed very well equipped makerspaces within their campuses, similar to the quality of their laboratories and technical workshops. For instance, MIT, StfU, UCm, ICL, UMch, GIT, UPC and UPM count on outstanding and full-equipped official makerspaces, some only for engineering students. Most of these

makerspaces studied offer open-access for all the university community, except MIT and University of Cambridge that only allow engineering students. Other cases are StfU, UPC and UPM makerspaces, which require an initial payment to become an official user. Some makerspaces such as UCB are created mainly oriented to work on 3D printing, robotic and electronic devices. HrdU have a whole building devoted to entrepreneurs on any field with access to 3D printing, electronics and rubber molding. The UOxf and NUS makerspaces are located inside the library and mainly oriented to experiment with 3D printing and electronics. A common practice is to request users to bring or pay for the material to be used. Regarding organization, both faculty and technical (dedicated) staff are running the makerspaces. The websites of the MIT, UCB, GIT and UPV student-run-makerspaces are well-organized and very active in personal projects and national and international competitions. In other cases such as the Supernode (UCB) and ‘Maker UPV’ (UPV), students’ initiative was an essential factor for their creation, and they are still mostly run by these groups of students. All these cases of makerspaces share something in common, that is, the first resources incorporated are always the 3D printers, together with some computers. These observations are in agreement with those reported by (Barrett et al., 2015) and (Wong and Partridge, 2016).

Regarding the Spanish universities studied, it is worth highlighting that ‘Makers UPV’ has neither headquarters nor fixed material resources. However, they are one of the most active campus makerspaces in Spain. ‘Makers UPV’ is a free-access makerspace, run solely by students with remarkable national and international recognition. Recently, they also won some prestigious competitions such as the ‘Hyperloop Space X’, 2016 edition (www.spacex.com/hyperloop). They also promote enlightening and educational activities about technology for children. This situation demonstrates that it is not indispensable to count on a sizable budget to implement an efficient campus makerspace. Lastly, authors’ experience on building up the University of La Rioja makerspace (UR-maker) is reported in the following sections as an example of a makerspace with significant presence of students’ initiative.

4. The UR-Maker Experience

The University of La Rioja (UR) (www.unirioja.es) is a relatively small university with around 7k students and 9 STEM (Science, Technology, Engineering, and Math) degrees. UR-Maker project emerged thanks to students’ initiative and faculty staff involvement. After understanding the importance of a makerspace in higher education, an enthusiastic UR governing body joined the project and the UR-Maker was officially inaugurated at the end of 2016 (October 19th). The UR-Maker is run by students and faculty staff and has well-equipped, free-access makerspace for the entire university community.

4.1. Space layout

One of the most complicated steps when creating a makerspace is to find a physical space inside university buildings. Luckily, an underused metrology laboratory was available. After some minor changes we adapted this space as a makerspace, distributing its 88 m² in 8 different areas: 3D printing, electronics, hand-tools, machining, 3D scanning, assembly, design and quality control zones. The laboratory has natural light, one entrance, and the compulsory emergency exit. The location into the campus is extraordinary being near a room equipped with computers for design and simulation activities, and the main manufacturing workshop of the engineering school.

4.2. Kick-Starter of the UR-Maker and economic sustainability

The total amount of investment at this moment is 9k€. The university provided the starting funding of 6k€ for buying new 3D desktop printers with friendly interface and auto-leveling system, which are essential for facilitate the use of the machine among the novel users. Other components for DIY activities included: common tools (hammers, pliers, screwdrivers, etc.); small power tools (rotatory tools, small drill-press, drill, fretsaw, jigsaw, etc.); measurement tools (handheld multimeter, electronic calipers, etc.); a basic photo set (to document the projects) and basic mechanical and electronic items. Additionally, several DIY desktop machines (three RepRap 3D printers, a mini CNC-PCB-mill and a mini 3D scanner) were purchased thanks to three consecutive teaching innovation projects (APIDUR 2013, 2014 and 2015). Furthermore, understanding the relevance of the project, all departments transferred several items to the makerspace (electronic equipment, lockers, etc.). Because of the proximity and open access to the campus manufacturing workshop we have not include heavy machine tools in the UR-Maker. The size of the budget shows that it is not indispensable lots of money.

The current funding mechanisms of the UR-Maker include the university's internal budget, projects with local companies and various collaboration agreements with other entities such as www.fffworld.com/en/, www.bq.com/es/mundo-3d, www.jae.es/, and www.aprendiendoarduino.com. Some donations from private organizations (<http://www.leroymerlin.es/>) also increased the budget for 2017. Finally, the users have to bring or pay for the materials used as in most of the other makerspaces studied.

4.3 Website and social networks

The recruitment of users, publication of news and courses is always broadcasted on the website: <http://www.unirioja.es/urmaker/>, or by social media networks such as Facebook: <https://www.facebook.com/areaURmaker/> and Twitter: https://twitter.com/area_urmaker.

4.5. Activities at the UR-Maker

UR-Maker has become a meeting point for knowledge and experiences exchange, fostering in this way a maker community with several academic and personal projects hosted. Free basic and advanced training courses (3D design & printing, Arduino, etc.), social projects (3D printed toys for Christmas) and some local competitions have been carried out. Several open door days for people outside the university community were also organized to spread the maker movement. Concerning research groups and departments, the Maker-UR has been a tool for supporting some R&D and academic activities. For instance, ‘Unirioja Racing Team’ received supported for its preparation for the international competition Motostudent 2016. Shortly, we expect to increase the number of collaborations and agreements between the university and some companies.

2.2. Current limitation the UR-Maker

Several limitations were detected during the implementation of the UR-Maker. As a new entity in the UR, none staff has been permanently designated for organizing the makerspace, task mainly relying on students and faculty staff. Therefore, it is hard to generate long-term schedules, especially without an annual budget. Medium and long-term plans depends on personal and professional circumstances. Regarding accessibility and security, an automatic access system should be installed to allow registered and trained user to work in the UR-Maker. Authors are still working on these problems to enhance the services provided and increase the number of activities organized.

4. Conclusions

Makerspaces are community centers that provide a creative environment for active learning where hands-on and interactive elements are essential components. Makerspaces are also growing in the university campuses, particularly around the STEM careers, for being a bridge between academy and labor market. Herein, we evaluated the makerspaces of the top 10 engineering universities in the world, and three of the most well-known in Spain. Aware of their importance, most of these universities count on outstanding makerspaces, with 3D printers as the most common equipment for students in engineering degrees, and some of them are open to the entire university community. Interestingly, most of the students-run-makerspaces were originated by their own initiative. Nevertheless, active faculty members or staff is commonly the managers of most makerspaces. An exceptional case was found in ‘Maker UPV’ with very interesting activities and outstanding achievements in spite of their lack of material resources. We also described authors’ own experience implementing a campus makerspace (<http://www.unirioja.es/urmaker/>). Surprisingly, we did not find indispensable a sizable budget to start a makerspace in a university campus. Next steps will

include formal interviews for the assessment of the impact and relevance of the described makerspaces.

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Examining Preservice Teachers' Self-Efficacy for Enhancing Literacy of Diverse Learners through Music

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Abstract

The sense of efficaciousness for teaching diverse learners was examined with twenty-four pre-service teachers concurrently enrolled in a junior-level Creative Arts methods course and a field experience course with placements in K-2 general education classrooms. The pre-service teachers participated in music and literacy activities in their university class, then planned and implemented standards-based music activities in literacy lessons with their young students. Both quantitative and qualitative data were collected, including a teacher self-efficacy scale, an attitude survey, written reflections, interviews, open-ended responses, and lesson plans. Results demonstrated a significant increase in the pre-service teachers' self-efficacy in pre-post ratings analysis and indicated that this project contributed to their efficacy for meeting needs of diverse learners in the elementary classrooms. The pre-service teachers demonstrated proactive classroom management and reflected upon their students' increased focus in class. The pre-service teachers indicated that their success with these types of projects encouraged them to plan for similar implementation with their future diverse learners, potentially contributing to a positive impact on their future performance. Additionally, this project emanated Scholarship of Teaching and Learning by encouraging self-reflection; examining and applying effective teaching strategies; and advancing the field of teacher education.

Keywords: *Self-Efficacy, Diverse Learners, Music Integration, Scholarship of Teaching and Learning*

1. Introduction

Teacher preparation programs are challenged with equipping their candidates with the tools necessary for coping with the encounters, such as meeting needs of diverse learners, they will face throughout their practicum experiences and as they begin teaching in their own classrooms. Using music activities is one way to involve diverse learners in lessons, and the use of music has benefits that contribute to literacy development in young students. According to the Common Core State Standards Initiative (CCSS, 2012), literacy instruction is the responsibility of all content areas, which includes music education. Similar themes are shared between CCSS for English Language Arts (ELA) and the National Standards for Music Education (NAfME, 2014). Some of the commonalities and correlations between literacy and music education include demonstrating independence, having strong content knowledge, comprehending, critiquing, understanding other perspectives and cultures, phonological awareness, auditory discrimination, sight identification, orthographic awareness, fluency, and interdisciplinary connections of concepts through music (Coleman, n.d.; Hansen & Bernstorff, 2002; Isbell & Raines, 2013; Paquette & Reig, 2008; Weidner, 2013). Bernstorff (2013) reminds us that good music literacy can “provide the very same benefits as those who teach language reading, plus the enjoyment of an arts experience” (p. 2).

Identifying and addressing the needs of diverse learners has been cited as a weakness by the preservice teachers in our early childhood education program. During a recent study, those in the junior-level practicum frequently pinpointed the following two diversities as the most challenging in their Kindergarten through second grade English Language Arts (ELA) classes: attention or focus, and auditory processing (Arrington & Lu, 2015). Noting these weaknesses, it is important to provide opportunities for pre-service teachers to increase their efficacy for meeting the needs of their diverse learners. Bandura (1997), offers “Perceived self-efficacy refers to beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments” (p. 3). Perceived self-efficacy is not concerned with the amount of skill one has, but what he/she believes can be done with what he/she has in given circumstances. Bandura further asserts that experiences (referred to as *Enactive Mastery Experiences*) have the most influence on self-efficacy.

This project developed from a desire by the instructor of the Creative Arts methods course to enrich Early Childhood Education pre-service teachers’ practicum experience, ultimately leading to success in their future classrooms. The instructor’s goals in this project include (a) equipping them with skills gained from the Creative Arts class that can be applied in their ELA lessons with their young children, (b) providing them a potentially richer and more meaningful field experience through integration of the arts, (c) eliciting a more critical level of self-reflection, and (d) stimulating a higher sense of efficaciousness as they address the challenge of meeting the needs of diverse learners. This project emanates

Hutchings and Cambridge's (1999) definition of *Scholarship of Teaching and Learning* (SoTL): "...problem posing about an issue of teaching or learning, study of the problem through methods appropriate to disciplinary epistemologies, applications of results to practice, communication of results, self-reflection, and peer review" (p.7). Finally, Gardner (1993) posits that musical intelligence develops early in children; therefore, it is reasonable to introduce music-based activities to future teachers of early childhood classrooms.

2. Methods

2.1. Participants and Procedures

The participants in this study included twenty-four second-semester junior Early Childhood Education (ECED) pre-service teachers enrolled in a Creative Arts Methods Course. The course is taught by a former elementary music specialist/national board certified music teacher. The pre-service students participated in the creative arts activities during their university class, and planned/implemented instructor-approved, standards-based music activities with literacy lessons during their concurrent field experience course in assigned Kindergarten, first, or second grade classrooms. They completed pre- and post- self-efficacy scale ratings at the beginning and end of the course. Throughout the semester, they submitted self-reflections and ratings based on their experience and attitude toward their class participation, lesson planning, and implementation of the activities in their practicum classrooms.

2.2. Methodology

Multiple methods were used for data collection and analysis in this study. Quantitative data consisted of the *Teacher Self-Efficacy Scale* (Bandura, 2006) as a pre- and post-test measurement; a beginning and endpoint Likert rating scale which contains five items from the *Teacher Self-Efficacy Scale* directly related to addressing diverse learners; and an attitude survey with Likert-scale rated items regarding the pre-service teachers' implementation of creative arts activities in their classrooms. Independent samples *t*-tests and paired differences tests were conducted to determine the differences between the candidates' pre-post self-efficacy mean scores; between their rating scale scores, and between their attitude survey results. Qualitative data consisted of written reflections, interviews, and instructors' field notes, Creative Arts lesson plans, and open-ended responses on the attitude survey. The data was coded and organized to reveal recurring themes.

3. Results

Quantitative results revealed a significant difference between the pre-and post-scale general teacher self-efficacy ratings (see Table 1). The statements on the survey specifically related to their self-efficacy for meeting needs of diverse learners included items #5-9: (5) getting through to the most difficult student, (6) promoting learning when there is lack of support from the home, (7) keeping students on task on difficult assignments, (8) increasing students' memory of what they have been taught in previous lessons (significance indicated), and (9) motivating students who show low interest in schoolwork (see Table 2).

Table 1. Pre- and Post- S.E. Scale Ratings

	Paired Differences			<i>t</i>	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Pre-Post Assessment	-.36	.81	.17	-2.18	23	.04

P<.05

Source: Arrington (2017).

Table 2. Comparison of Means – S.E. Meeting Diverse Needs

Statement	Mean	Std. Deviation	Std. Error Mean	<i>t</i>	df	Sig. (2 tailed)
5	-.04	1.23	.25	-.17	23	.870
6	-.29	1.00	.20	-1.43	23	.166
7	-.04	1.33	.27	-.15	23	.880
8	-.63	.92	.19	-3.32	23	.003
9	-.08	1.02	.21	.40	23	.692

P<.05

Source: Arrington (2017)

Students rated their attitude toward the effects of implementing their music-based activities. First, they considered sharing their activities with peers in class versus implementing the activities with their K-2 students, and then they rated the level of the activities' contribution to their (a) efficacy for meeting the needs of diverse learners in their classroom, (b) understanding of integration of creative arts in the elementary classroom, and (c) efficacy for integration of creative arts in the elementary classroom. Only two students indicated that sharing with peers contributed most to the above-named criteria. Seventeen students indicated that implementing with peers and K-2 students contributed equally to their understanding of and efficacy for integration of creative arts, whereas only 9 indicated that they equally contributed to efficacy for meeting needs of diverse learners. Fifteen responded that implementing with their K-2 students provided most efficacy for meeting

needs of diverse learners and less than seven indicated that K-2 implementation contributed to understanding of and efficacy for creative arts implementation. See Figure 1. Additionally, students rated their attitude toward the implementation of their music-based, or similar, activities in future classrooms. One student indicated that he/she was very unlikely to implement, but eighteen indicated that they were very likely to use similar project in their future classrooms (see Figure 2).

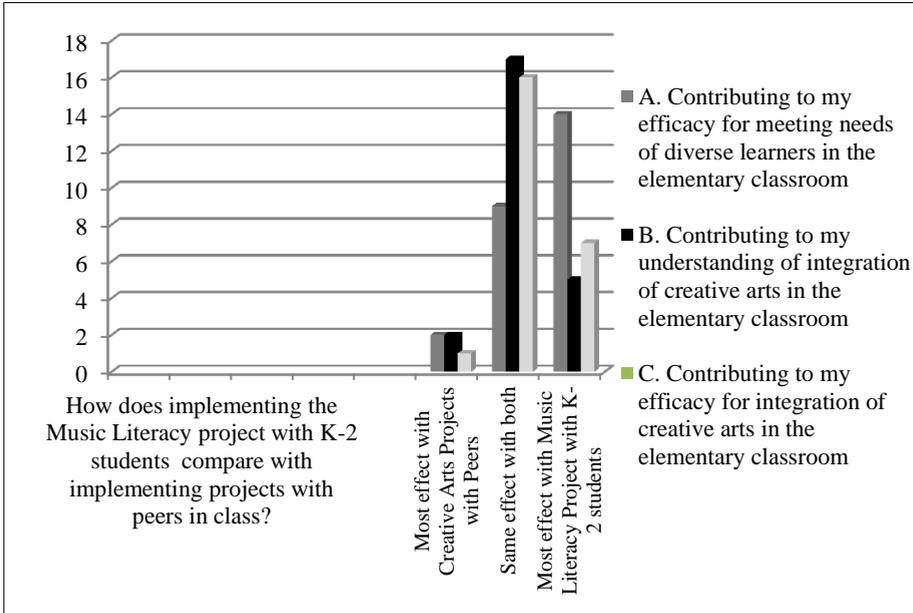


Figure 1. Attitude toward Contributions of Music Literacy Project. Source: Arrington (2017)

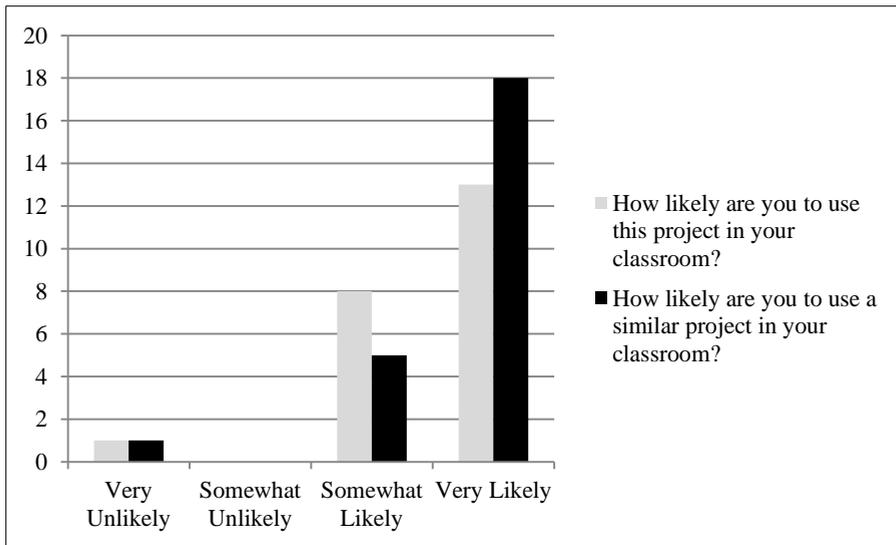


Figure 2. Attitude toward Implementation of Music Literacy Projects in Future Classrooms.
Source: Arrington (2017)

In the qualitative analysis, reflections and open-ended responses were coded. Three major themes emerged, as follows: (a) pre-service teachers' learning experience, (b) diverse learners' learning experience, and (c) behavior management. Excerpts are provided (see Figure 3).

THEME: Pre-Service Teacher Learning
“It was hard work putting this together and setting this up. But it was worth it. It made me realize that with a little extra time and planning, music can be integrated into other curricular areas and the students can learn a lot from it...” (PST#1).
“It definitely helped me see the importance of using creative arts in the classroom” (PST#2).
“[I saw] firsthand by being involved that you can teach content in different ways...” (PST#2).
“I think this activity showed me to think outside the box when planning...” (PST#4).
“It also made me think of different aspects of creative arts that could be used to help diverse learners, especially if they are more drama filled or movement/dance filled. It would work best to incorporate all aspects of creative arts in the classroom...” (PST#6).
“It made me want to incorporate music into my lessons more often...” (PST#8).
“I really liked that we were able to do this with our elementary class instead of trying it on our fellow classmates. It gave me a better idea of how it would be if I used it in my future classroom” (PST #11).
“I am very happy that I had to do this music literacy lesson...I have never really enjoyed music or wanted to teach with it but after the lesson I will definitely be doing it more often...” (PST#9).
THEME: Diverse Student Learning
“This activity impacted the diverse learners by keeping their interest and it gave them something to do hands on, which really helped them stay focus [<i>sic</i>] and on task” (PST#3).
“During this lesson students needed to pay special attention to their specific roles, listening carefully for their cues to play their instrument. Specific students were assigned certain instruments for a reason. ... all students were able to stay engaged during the lesson as everyone was actively listening for their assigned cue...by hearing the sounds and seeing the motions, both visual and auditory learners were able to more closely follow along with the story, thus aiding their comprehension...” (PST#9).
“I have a class that normally misbehaves a lot. But conducting this activity got everyone involved and they loved it. I was actually shocked at how well they all participated” (PST#2).
“I think doing activities like this can really help you get your students involved and actually want to participate” (PST#3).
After hearing “Wow, this is fun!” and “I wish we could do this a lot more,” I realized the impact that the instruments had on their interest and overall participation and comprehension...” (PST#5).
THEME: Behavior Management
This lesson had the potential to go horribly wrong. I was very nervous to give a group of six year olds musical instruments, but with a well thought out behavior management plan and a little enthusiasm I was surprised at how well it went (PST#9).
I loved watching the students during this activity...At first I was rather apprehensive, thinking I would have a hard time controlling the students while they all were playing. However, the lesson far exceeded my expectations. Every student had a smile on their face during the lesson...it was so lovely to see (PST#10).

Figure 3. Themes from Student Reflections. Source: Arrington (2017)

4. Discussion

During their self-reflections, the pre-service teachers indicated they will utilize their arts lessons or similar activities in their future placements and classrooms. Traditionally, some had been hesitant to “think outside the box” to integrate the arts—sometimes due to lack of confidence or experience in the arts, or sometimes due to a perceived lack of time during their lessons. Although these pre-service teachers are not expected to teach music at the level of a specialist, they are able to use experience and knowledge gleaned in their university course—working with the music standards and making connections with common skills of literacy and music such as processing, decoding, and analyzing (Weidner, 2013). As a result of this project, the pre-service teachers have indicated a higher level of self-efficaciousness for implementing these types of experiences in their future lessons.

Tomlinson (2015) reminds us that the “nature of 21st century students will require classroom teachers to be more responsive to the “broadening array of cultures, languages, experiences, economics and interests represented in most contemporary classrooms...” (p. 203). A major component of this project addressed how the arts can be used to accommodate diverse learning styles in their classrooms. As evident in the pre-service teachers’ Creative Arts lesson plans, they are becoming more experienced in assessing their students’ needs and in planning a variety of developmentally appropriate activities to address those needs. Based on the reflections of successful experiences during the music integration lessons, this project has enriched pre-service teachers’ planning and teaching in both courses--Creative Arts and their first Practicum Course.

As our teacher education program continues to prepare our pre-service teachers for their upcoming certification requirement during student teaching—edTPA, a student teacher performance assessment developed by the Stanford Center for Assessment, Learning and Equity—there will be more emphasis in our program on the intense reflective component. Inasmuch as reflection was a vital component of this experience, the pre-service teachers will be better prepared to reflect on their experience at a level exemplary of teachers who are prepared for teaching all students (AACTE, 2013). Drawing from success with their music integration lessons, our teaching candidates will be better prepared to teach ALL students—being able to identify and accommodate their K-2 students’ diversities, and becoming more self-efficacious in the process.

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How about equality and equity in higher music education?

A theoretical framework for researching quality of music teaching and learning

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Abstract

While quality development has an important role in higher education in Finland, its connection with equality and equity in teaching and learning music is not often mentioned. Most of the discussions about equality in education have focused on how to equalize access to and participation in education, but there are disagreements about what the very concepts of equality and equity mean in education. When striving to achieve equality in higher music education, the use of learner-centered pedagogies may promote an engaging and satisfying learning experience. We illustrate a more holistic approach in teaching and learning music by adapting the equality-equity model developed by Espinoza (2007) to give an overview of dimensions of equality and equity with reference to the different stages of the educational process at the music university level. Constructivist research and phenomenographic research in teaching and learning music suggest that the conceptions held by teachers and students about teaching and learning can be relevant factors in the pursuit of change in educational practices. On this basis, we develop a theoretical framework and suggest some remedies for the research of teaching and learning in music universities aimed at developing more holistic quality in higher music education.

Keywords: *Constructivism; Equality; Equity; Higher music education; Phenomenography; Quality*

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1. Introduction

“At the heart of teaching others is the moral imperative to care. It is the imperative to perceive and act, and not look away.” (Allsup & Shieh, 2012, p. 48).

This study discusses the quality of teaching and learning at the music university level (church music, classical music performance, composition and music theory, conducting, folk music, global music, jazz music, music education, music technology, and arts management) by providing an in-depth examination of equality and equity as a starting point in higher music education.

According to Allsup and Shieh (2012), it is important to notice and identify inequities in music education by shedding light on teachers’ teaching techniques and attitudes and by allowing students to enter curriculum with teachers as agents of change. To ensure that everyone has an engaging and satisfying learning experience, Lynch and Baker (2005) argue that there is a need for a more holistic approach to the achievement of equality in education, because most of the discussion about equality in education has focused on how to equalize access to and participation within different levels of formal education for different social groups.

Very often, equality is used as if it were interchangeable with equity, and as an idealistic and abstract concept, when considering education. For example, educational equality is mentioned as one of the six comprehensive themes in the evaluation of projects in education in Finland (Finnish Education Evaluation Centre, 2016). In this study, we adapt the equality-equity model (Espinoza, 2007), which is grounded in the critical theory paradigm, to examine equality-equity in teaching and learning music in reference to the different stages of the educational process at the music university level. The goal is to develop a theoretical framework and suggest some remedies for the research of teaching and learning in music universities aimed at developing quality in higher music education.

2. Quality of teaching and learning in higher music education

People’s beliefs about normal and abnormal affect to the ability to perceive the world as if it could be otherwise (Allsup & Shieh, 2012). High quality professional development can provide music teachers with knowledge on student thinking and learning, which enables them to meet the needs of students when designing learning activities and curriculum materials (Bautista, Yau & Wong, 2016). Reform initiatives around the world emphasise the importance of using student-centric pedagogies and learning activities that respond to students’ ideas and interests (Darling-Hammond, Chung Wei, Andree, Richardson & Orphanos, 2009).

In the same line, research in instrumental music instruction has shown that the beliefs and practices of constructivist teachers who focus on students' prior knowledge and motivations can have a positive impact on students' learning strategies, teaching and learning beliefs, studying autonomy, and sense of engagement in the classroom (López-Íñiguez & Pozo, 2014a; 2014b; 2016), all factors related to the quality of teaching and learning music. These results resonate with Johansen (2007), who emphasises the significance of systematically conducted research as a bottom-up activity - based on data collected from teachers' and students' experiences of teaching and learning processes within their specific subjects - when establishing quality systems in higher music education.

Quality assurance in higher education has been one of the most fundamental aspects of the establishment of the European field of higher education. The universities in Finland are expected to achieve high quality results, and demonstrate an ability for reform in action as well as for competitiveness and effectiveness (Finnish Higher Education Evaluation Council, 2013). Espinoza (2007) questions whether there can be equality and equity in a society when the society prioritizes efficiency in resource management over social justice. He also shows that, although there are many discussions of equality and equity among researchers, there is disagreement and confusion about what those concepts mean and involve for the different levels of the educational system.

3. Equality and equity dimensions in teaching and learning for the different stages of the educational process at the music university level

Espinoza's (2007) equality-equity model is a valuable tool when pursuing a more holistic approach in teaching and learning at the music university level, because it considers equality and equity in terms of their interacting implications for social and educational policy which affects individual well-being. The model shows that it is not possible to argue for a simple conception of equality and equity.

According to Espinoza (2007), in relation to education, the concept of equality is usually connected with the idea of sameness in treatment, by stipulating the fundamental or natural equality of all individuals. The concept of equity is associated with fairness or justice when participating in education, through considering individual circumstances. Greater equity does not generally mean greater equality because, on the contrary, more equity may mean less equality. Table 1 illustrates an analysis of the dimensions of equality and equity in teaching and learning at the music university level.

How about equality and equity in higher music education?

Stage of the educational process	Teaching in the music university		Learning in the music university	
	<i>Equality</i>	<i>Equity</i>	<i>Equality</i>	<i>Equity</i>
<i>Financial, social and cultural resources</i>	There are no financial, political, legal, social, and/or cultural constraints for teaching in music university	Teaching in the music university is offered with same resources to all those individuals or groups* who have same needs or potential to learn music	An individual is free to make a choice without any restrictions whether or not to study in the music university	All individuals or groups* who have same needs or potential to learn music have same amount of resources for studying in the music university
<i>Access to education</i>	Tuition in the music university is provided to all individuals	Instruction in the music university is provided same way for individuals and groups* with same needs, abilities and past achievements and different way for individuals and groups* with different needs, abilities and past achievement	All individuals are admitted to higher music education within the same context and/or in a separate but equal context no matter if they utilize that opportunity or not	Access to music university is provided for individuals and groups* to the same level with same needs, abilities and past achievements and to the different level with different needs, abilities and past achievement
<i>Educational attainment and achievement</i>	Teaching is provided to all music university students as long as they need it for graduating with good scores	Teaching is based on music university students' or groups'* equal needs and potential and effectivity to ensure equal level of attainment and achievement	All music university students can obtain the same level of educational attainment and achievement and complete degrees without any time limitations	Music university students or groups* with equal needs and potential gain equal level of attainment and achievement and equal resources are allocated according to same success and effectiveness in using past resources
<i>Outcome</i>	Music university degree guarantees that individuals gain wanted occupational status, income and political power	With equal music university degree individuals or groups* obtain equal jobs, income and political power	After graduating from music university, all individuals gain the kind of job and income they want and access to sites of political power without barriers	After graduating from music university, all individuals or groups* with equal needs and potential and achievement obtain equal jobs, income and political power

* socio-economic, ethnic, gender or other relevant category of individuals

Table 1. Equality-equity in teaching and learning music, in reference to the different stages of the educational process at the music university level. Table is adapted from the equality-equity model developed by Espinoza (2007).

4. Teachers' and students' conceptions about teaching and learning music

Some of the most relevant factors in pursuing change in educational practices are the conceptions held by teachers and students about teaching and learning, and in the field of music there can be found much research in this area (e.g. López-Íñiguez & Pozo, 2014a; 2016). From the perspective of investigating conceptions in teaching and learning music, constructivist research and phenomenographic research may offer feasible frameworks for aiming to achieve equality in higher music education.

Constructivism is a learning theory which finds similarly related representations in Dewey's, Piaget's, Bruner's, and Vygotski's ideas in the 20th century, concerning the nature of knowledge and how human beings learn and understand the learning process. According to constructivist principles, that understanding is constructed based on the learners' previous experience and background knowledge, and individuals construct their own new understandings through the interaction of what they already believe and the ideas, events, and activities with which they come into contact (see an in depth description in Pozo, Scheuer, Pérez-Echeverría, Mateos, Martín & De la Cruz, 2016).

López-Íñiguez and Pozo (2014b) have shown that studies of how teachers and students represent the learning and teaching of instrumental music during childhood tend to identify two extreme instructional positions: one focusing on the transmission of established knowledge, usually called traditional or transmissive, and the other, usually known as constructivist, focusing on the students' knowledge and capabilities. The later approach fosters cooperation through more dialogical learning spaces and promotes student metacognition and self-regulation. Teaching according to constructivist principles requires activating, stimulating, and developing the student's mental processes through reflection and scaffolding. The aim is for students to learn to autonomously regulate and manage their own cognitive and motor processes, and to build unique and inspiring representations of the music they play, through the guidance and supervision of teachers who focus on the students' reflective, metacognitive, emotional, and affective processes.

Studies on the conceptions and practices of teaching and learning music show that these still largely focus on transmitting the musical and technical knowledge needed to produce the correct sound (e.g. Bautista, Pérez-Echeverría & Pozo, 2010; López-Íñiguez & Pozo, 2014b; Marín, Scheuer & Pérez-Echeverría, 2013). These studies have found that there is a relationship between teachers' conceptions of teaching and learning and the way they process musical scores, such that simpler conceptions correspond to simpler processing levels, while constructive conceptions would promote more complex ways of understanding scores. According to Gaunt (2008), it seems that even though teachers are aware of the theoretical assumptions underlying constructivist models, very often they are unable to put them into practice successfully in the music classroom. López-Íñiguez, Pozo, and de Dios

(2014) argue that a conceptual change (in line with Vonsiadou, 2013) would make it possible to implement progressive changes in teaching practice, moving from traditional regular, repetitive activities towards more holistic instructional practices.

Another approach which can be considered in the implementation of research practices in the study of equality-equity in higher music education is phenomenography. Phenomenography is a research approach that is particularly aimed at questions of relevance to learning and understanding in an educational setting by considering people's conceptual thoughts (Marton & Booth, 1997).

Since the mid-1970s, there have been a large number of educational studies deriving from the work of Marton and Säljö (1997). The key concept that emerged was the approach to learning with its categories of deep and surface. The deep approach to learning means student's efforts to understand learning, critical and analytic studying, and managing entities. The surface approach to learning means emphasising study through repeating things and memorising. Subsequently, Entwistle and Ramsden (1983) added the third category of strategic approach to learning. Research has shown that a deep, strategic approach to studying is related to high levels of attainment in higher education (Entwistle, Tait & McCune, 2000). Entwistle (2009) emphasises that it is important to clarify for each subject area and each topic the processes of learning that are necessary to develop deep conceptual understanding. This stance is crucial in music universities, where one-to-one instruction comprises the main part of studying, and the differences in the contents and teaching methods of subjects and study programmes can be enormous.

There are a few studies on the approaches to learning in higher music education. In her study, Reid (2001) described the different ways that instrumental and vocal students experience, or understand, learning in higher music education. The research findings constituted five categories for the description of learning instrumental music: Instrument, Elements, Musical meaning, Communicating, and Expressing meaning. Sullivan and Cantwell (1999) investigated the planning strategies of university music students' learning of a traditional and non-traditional notated score, and the findings indicated that, even among the more expert musicians, deep learners were more likely to address a musical score at a higher level of meaning through the use of a deeper and wider array of processing strategies than surface learners.

5. Conclusions

Espinoza's (2007) equality-equity model, combined with constructivist or phenomenographic research, offers valuable findings when pursuing a conceptual change in teaching and learning music. The findings indicate that there is a need for a more holistic approach to the achievement of educational change, in terms of learner-centredness in the music classroom. Researching holistic versus traditional teaching-learning practices might eventually shed light on the effects that instructional practices have on equality and equity. When taking into account equality and equity in students' well-being, research on the workload in studies could be relevant, especially in the music universities, where students may face unique sources of stress, performance anxiety, perfectionism, and career concerns.

As Espinoza's model shows, it is not possible to achieve full equality and equity, but there is always the possibility to aim for increasing equality and equity in different stages of the educational process. Holistic instruction would cover those aspects sufficiently, therefore effecting equality and equity, because 1) all people are accepted to study and to be treated as individuals; 2) resources are available for everyone's needs; and 3) attainments, achievements, and outcomes are co-decided and co-assessed between the educational agents, acceding to the individual's needs, interests, potential, and capabilities. When considering equality and equity as crucial factors in quality development in higher music education, this has implications both for educational policy and also for practical changes in teachers' teaching and students' learning and well-being.

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Students service learning experiencies in Mexican Microenterprises

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Abstract

This paper presents an experience of a service learning program in underprivileged Microenterprises. It shares the experience of Program for Research, Assistance and Teaching of Small Enterprises, an innovative model of assistance to deliver Business Development Services to low value added Microenterprises, including technical assistance and training with the participation of senior students, which act as advisers to the Microenterprises, implemented in the State of Baja California, Mexico, by The Autonomous University of Baja California. This program was propused as compensatory mechanism for the unemployment burden created by the low growth prospects. From 2009 to 2016, with about 1,500 students, the program has assisted, trained, and formalized in the tax institution about 11,300 individuals running microenterprises, which in addition, most of them have become subject to and has been given financial support by the goverment. The paper suggests that service learning programs with the participation of college students can play an important role both in supporting disadvantaged microenterprises and in providing meaningful learning experiences to students.

Keywords: *Service learning; business development services; public policy.*

1. Introduction

Service-learning (SL) is an approach to learning-by-doing that highlights the social relevance of the work performed by universities. It can be regarded as an augmentation of the concept of Community Service (CS) with the inclusion of a learning component that may carry academic credits or may be part of a specific course requirement (Rhoads, 1997). The fundamental idea is that students learn and develop themselves through active participation in communitarian experiences organised and led by faculty, where they have the opportunity to apply the concepts and instruments recently acquired to help their community (Yates and Yuniss, 1999). More formally, SL is a method of experiential learning that links the classroom with the local community, and requires students to spend time in volunteer service and relate their experiences to the educational knowledge they see in the classroom (McGoldrick, 1998). Dewey can be considered as a pioneer in integrating experiential learning into education and thereby constitutes a background for the SL pedagogy. He argued that the lessons learned when students are concerned for the welfare of others provided not only an educational stimulus but also an expansion of their horizons and encouragement to take responsibility for their fellow humans (Dewey, 1938).

This approach has been added to other modern education mechanisms, which focus on restructuring the learning processes within the classroom, even from basic levels. One of them is aimed to encourage entrepreneurship and creativity among primary school pupils than they acquire entrepreneurial skills through running a business. This type of teaching help the entrepreneurship education stakeholders increase the effectiveness of entrepreneurship education programmes and actions aimed at promoting firm creation (Barba & Atienza, 2016). Another project is to restructure the traditional classroom, under a new design that improves the educational environment by modifying student seats, tables, equipment, location of the instructor etc., achieving an the active learning classroom, which increases understanding of the student, greater participation and communication with the instructor, improving levels of school achievement (Park & Choi, 2014).

On the other hand, Business Development can be understood as a package of conditions providing the elements for the businesses to prosper in a market based economy, where several complementing institutions and organizations play a role. Perhaps the most acknowledged elements for small business are financial and non-financial services. The former is compounded by the well-known models of Microfinance, as well as other services like deposits, insurance, and payment services. The later includes a broad range of services attempting to provide the entrepreneurs some basic assets for livelihood, particularly human capital, by developing skills and knowledge (Carney, 1998). These services are often referred to as Business Development Services (BDS): training, technology transfer, marketing assistance, business advice, mentoring and information, which are aimed at helping the entrepreneurs improve the performance of their businesses (Goldmark, 1996).

The Program for Research, Assistance and Teaching of Small Enterprises (PRATS) was created as a CS program in 1999 at the Autonomous University of Baja California (UABC), Tijuana, Mexico, with the participation of few students and microenterprises (MEs), but was implemented systematically since 2001 with the support of funds. In the most general way, PRATS has been designed to take advantage of the human and physical capital, as well as other intangible assets already in possession of the Public Universities System. It also attempts to fit the organization and institutional arrangements governing HEI, to the growing concern of the government and other non-government organizations about microenterprise development, and on sustainable ways to care for such a broad sector of society. Thus, resources such as faculty, students, networks, facilities, equipment, and other assets become more socially profitable by being optimally used in favor of society.

The main objectives of PRATS are delivering BDS *in situ* at no cost to unprivileged enterprises, conduct research on small firm development, and build up a model of teaching, and learning for students in the field of Economics, Business, Management, and surrounding disciplines. From the HEI perspective, PRATS constitutes a SL approach of teaching, encouraging the students' professional learning, experience and entrepreneurial skills; and a research-action method of doing research while providing care, thus not only empowering their linkage to society, and the teaching-learning process, but also making pertinent research (Mungaray, Ramírez-Urquidy, Taxis, Ledezma & Ramírez, 2008)

2. The Program for Research, Assistance and Teaching of Small Enterprises

The program provides the students the opportunity to apply their profession, access their social context, and develop a feeling of affection for their community and the value of solidarity (Mungaray and Sanchez, 2003). Students in PRATS attend the microenterprises for a twelve-week period and work as consultants, developing a complete program of data collection, processing and analysis, ending up in a report on the enterprise's performance to be provided to the entrepreneurs, and comments for improvement. While the students involve with the entrepreneurs, they transfer knowledge, economic and business concepts, and management and technical skills, allowing these agents acquire some human capital that they would have never gotten otherwise. In addition, the *in situ* assistance constitutes also an on-call response to specific problems the entrepreneurs confront with, where the students can serve as a consultant during the weeks they engage in the enterprise operation.

The academic, educational and social impact of the project has been attractive to NGO's, government organizations and some universities, which have funded aiming to transform PRATS into a model that enable other HEI to reproduce it as SL program in their respective geographical regions. Thus, the State Government of Baja California, Mexico, through the Ministry of Economic Development, and the Autonomous University of Baja California

(UABC) have implemented a comprehensive program of microenterprise assistance since 2009, based on the PRATS designed by UABC. This program has become a public policy with the collaboration between the State Government and the State Public University (UABC) (Mungaray, Ramírez, M., & Ramírez N., 2014).

2.1. Student Recruitment and training

The model incorporates students in the fields of management and accounting, business, economics, marketing, international business and other related fields, who have an interest in helping MEs. The program coordinators evaluate students enrolment requests to enter and conduct meetings with the interested students. These meetings are intended to familiarize the students and describe the main components of the program. The meeting also intends to emphasize the importance of the students work in MEs and also the importance of their participation in the project as a State Government Public Policy to support the MEs and promote employment.

The project offers a training program for participating students. The training program is intended to cover some of the basic elements that students apply in MEs in order to standardize the framework of concepts among students. The topics concern the development of MEs. The experience during the existence of the program plays an important role in providing real cases, and concepts on business, finance, economics, markets and business regulations, among other related topics. The training program reviews many of the skills and techniques learned by the students during their careers, using real data from MEs that were previously assisted. The training phase plan also establishes what students perform in business.

2.2. Selection of Microenterprises

One of the disadvantages of some support programs is that entrepreneurs should attend the service provider's locations, and not the other way around. This becomes an important element discouraging the MEs to receive services, as they have to leave their tasks and routines in their business. Given that entrepreneurs in these businesses develop multiple tasks such as management, production, sales, among others, leaving their businesses produces a considerable opportunity cost. To overcome this, the students themselves seek the MEs in various ways, either by visiting slums door to door, going to community centers, schools and other infrastructure in neighborhoods. The disadvantaged MEs operate within their homes in what is known as family workshops. Other MEs are more visible as they have separate from home in independent workshops. Other contact mechanisms are the State Government office and University facilities.

The MEs eligible for the program are those that are considered underprivileged or low value added, operating in the informal sector, whose sole owner performs many of the

relevant activities in the business, predominantly employ family members, and have no separation between the resources of the business and home. These units can be considered as self-employment enterprises and originate from precarious macroeconomic conditions, recession and unemployment. Besides, they also originate because their owners lack of better working alternatives because they have a low level of education and training (Mungaray et al., 2014).

While officially MEs in Mexico are those units no greater than 10 employees, typically micro social base have an average of 2 to 5 workers and where the family plays an important role. This definition takes practice using regulatory criteria for eligibility that are applied by students in their search. According to this view, MEs should have no official or institutional support by some other program, lack of formal registration before tax authority, lack of accounting or formal administrative system, and owners should have primary education, secondary, or high school at maximum. These criteria make easier to reach the most modest MEs and ensure the relevance of the work done by students, and realize the social profitability of the project.

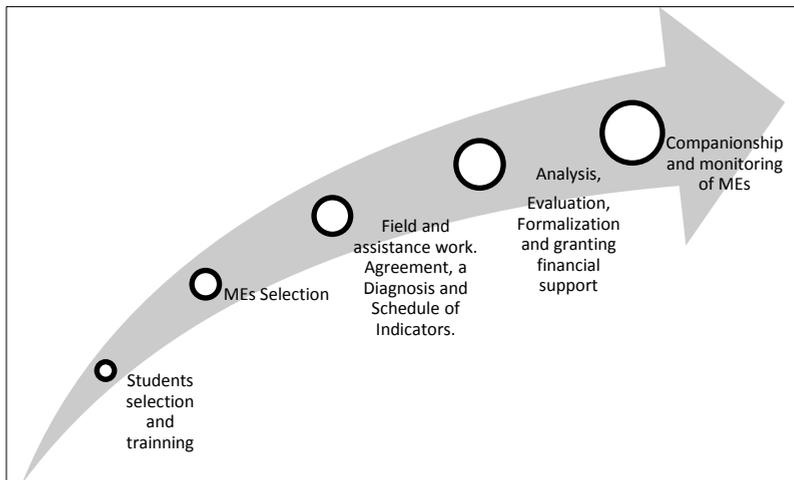


Figure 1. Model of assistance. Source: Mungaray, et al. (2014).

2.3. Assistance and training to micro individual and groups

The work of supporting MEs requires several visits and interviews with the entrepreneur, some of which are carried out either as a group training in workshops. Students enrolled in the programme attend the microenterprises for a three months period and work as consultants. The students' consultancy is provided within a framework of instruments and tools that formalise the relation between the entrepreneurs and the University. This framework characterises the enterprise profile, guides the data collection and report generation, and defines indicators to assess the productive units.

There are three main tools: an Agreement, a Diagnosis and Schedule of Indicators. The Agreement is a written document which formalises the participation of the MEs in the programme. The Diagnosis is a comprehensive survey applied by the students at the beginning of the assistance phase which constitutes a baseline to start intervention and includes preliminary information about the MEs. The Schedule of Indicators is a record of the operations of the MEs and indicators monitored on a daily or weekly basis. These include sales, output, costs, usage of inputs, and wages, among other variables, which are then used to construct an enterprise financial and economic profile (Mungaray et al., 2008)

2.4. Analysis, evaluation, formalization

At the end of the assistance period in the MEs, students analyze the data they collected in order to assess the enterprise formally for a written report. This stage is developed by the support of the Copy righted Software for Microenterprise Assistance (SAM). The software generates economic and financial reports such as Cost Analysis, Income Statement, Net Cash Flows, Proforma Income Statement, and Analysis of Financial Ratios and Break-Even Point. The software not only allows registering and storing socioeconomic information of the MEs engaged in the program, such as personal data, education, experience, among others, but also storing relevant data on the MEs such as capital, assets, financial structure, strategies, revenues, costs and expenses; and generates financial and economic reports such as cost Analysis, Statements of Income, Net Cash Flows, Proforma Income Statements, Financial Ratios Analysis, Breakeven Analysys and the results of the Economic and financial Evaluation.

2.5. Accompaniment, ME assistance, and support and the Follow-Up.

Once the MEs have taken on the challenge of being in a context of formality, and received financial support, a process that lasts three months from initial contact, the program continues to a stage accompaniment to enhance the ME position in the context of formality and the new obligations that the MEs have before the Tax Authority. In this stage, the assistance process continues on MEs organization and the entrepreneurs tax compliance; the data collection through SAM continues. Besides, the MEs training is intensified by two

more workshops on Finance, and Marketing and Security issues in the Business. These workshops are intended for the entrepreneur to learn about to how to apply for a finance, finance requirements, implications of the enterprise leverage, funding amount, interest rate, period of grace, the concept of risk, opportunity cost, short and long term inventory investment or machinery and equipment, sales, income, cost of Sales, salary, sales strategies, product differentiation, cross sales, advertising, competition analysis, customer service, hygiene in production, among other concepts. In general, the entrepreneurs learn through these the importance of microfinance, planning, financing, analyzing competition, and other concepts.

3. Results

The program provided support to 11,308 microenterprises in urban and rural areas across the state, from 2009 to 2016. This amount of MEs were assisted, trained and supported with financial resources. They were, in fact, incorporated into the formal world, by promoting registration before the tax authority under the small taxpayer regime. In sum, these enterprise received training and were formalized and received nonrepayable financial support for more than 28 million pesos (2.2 million dollars approximately). The program also has incorporated 1,484 students who worked as consultant and helped the entrepreneurs to reach formality in addition to training. It is important to note that the program has benefited women entrepreneurs, since 73% of the supported entrepreneurs had this gender. In the future, the challenge is for MEs to be self-sustaining with organization, in addition to that the program should be transferred for free. It is a great challenge. It is also argued that students' learning is fostered by a method of teaching which is based on well established theories of learning. Evidence of the helpfulness of students' advice to MEs may be considered as one, rather demanding, way of measuring their learning.

Table 1. Supported microenterprise and students in the program of assistance, 2009-2016

Concept	2009-2013	2014	2015	2016
Supported MEs	10,047	619	424	218
Participating Students	1,302	77	62	43

Source: Own elaboration.

4. Concluding remarks

The results of the application of this program-policy for microenterprise development, suggest the possibility to provide effective training, assistance for formalization and business development services from a methodology and the participation of students. It has also shown that collaborative schemes, in this case, government, universities and microenterprises, can result in effective public policies supported by various actors, for the support the the small scale of these MEs requires. The evaluation of the policy has illustrated that not only that more than 11,300 MEs were formalized and trained, but also, it has shown the possibility that a selection of these businesses can aspire to higher levels of development derived from deepening in training, differentiated support and access to microfinance. The results suggest that the supported MEs not only transited to operate under a formal context and rules, but those who have transited successfully trough higher stages of business training under the program, has achieved better growth levels in sales and profits. This is a cornerstone in improving microenterprise prospects and welfare. The program did not measure learning of students directly, this is part of a future research agenda; rather it provided an assessment of the efficacy of the SL programme in achieving its goal.

This experience of program for microenterprise development by students illustrates what is possible to achieve socially by the collaboration between microentrepreneurs, universities and government. This collaboration has resulted in significant social benefits to individuals running MEs, students and effectiveness of institutions. This experience may be useful to other regions of the country.

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A competency development approach to learning for employment

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Abstract

Higher Education Institutions are increasingly aware of industry expectations regarding work-ready graduates. Work Integrated learning (WIL) and co-operative education initiatives are widely acknowledged for improving professional skills and work readiness, however, graduates often lack the 'soft' skills (communication, collaboration, problem solving) deemed essential for enhanced productivity and innovation in the workplace. Anecdotal evidence from the Professional and Community Engagement (PACE) program at Macquarie University, identified the difficulties that students experience in self-assessing employability skills.

This paper discusses the theoretical and practical development of a competency development approach to learning for employment using an Assessment Centre process model currently embedded in the curriculum of one PACE unit. Developed and coordinated by post-graduate psychology students, the model provides a set of behavioural criteria by which to assess student employability skills.

While there is little evidence in the literature of the use of AC's for enhancing undergraduate employability, preliminary research and evaluation findings from this project, suggest that the AC process can have a positive influence on the development of the 'soft' skills of employability.

Keywords: *Assessment Centre; soft skills, employability, competency; goal setting*

1. Introduction

Higher Education Institutions are increasingly aware of industry expectations regarding the work-ready graduate. Jackson (2010) asserts that institutions worldwide are accused of producing graduates deficient in the ‘soft’ skills deemed essential for enhanced productivity and innovation in the workplace (i.e. employability skills). A useful definition of employability skills is “a set of attributes, skills and knowledge that all labour market participants should possess to ensure they have the capability of being effective in the workplace – to the benefit of themselves, their employer and the wider economy” (CBI, 2009, 2011). Lees (2002) contends that employers seek graduates who demonstrate self-efficacy (confidence to succeed) and agency (ability to act), which support a range of beliefs and attitudes that enable critical reflection and adaptation to contextual variations.

Universities are shifting their thinking about how to produce work-ready graduates. Aligned with this objective, there has been a surge in the use of experiential, Work Integrated Learning (WIL) programs, in recognition of them being the superior choice for developing generic and employability skills (Smith et al., 2009).

The value of experiential learning in developing capabilities (knowledge, skills and behaviours) has been widely recognised by industry for many years. The Centre for Creative Leadership in the US developed a learning model for business executives based on 30 years of research into the factors that contribute most to their development (Rabin, 2014). Coined by Lombardo and Eichinger (2000), the 70:20:10 model suggests that leaders and potential leaders develop mainly (70%) from challenging on the job assignments (completing tasks or projects), partially (20%) from developmental relationships (coaching, mentoring, etc.), and finally (10%) from coursework and training (reading and listening).

This paper discusses the development of a competency development approach to learning for employment in WIL, using an Assessment Centre methodology in one Professional & Community Engagement (PACE) unit at Macquarie University. The PACE program offers undergraduate students experiential learning opportunities with local, regional and international partners. Through PACE, students undertake mutually beneficial work placements (WIL) that meet both the partner’s organizational goals and enable students to strengthen graduate capabilities, while gaining credit towards their degree. Designated as Macquarie University’s ‘signature program’ (Macquarie University, 2013, p.11), all PACE units are embedded in the curriculum, with the aim of providing a transformative student experience that assists students in developing as work-ready, civically-minded global citizens.

2. Competency development approach

2.1. Assessment center (AC) methodologies

ACs are best known for their use as a tool in the recruitment and selection of job candidates. Most research about ACs has focused on their use as selection devices, however, many organisations now use them as a development tool (Howard, 1997). ACs use similar assessment methods for both selection and development purposes, however, the assessment results are used very differently. The results of a developmental AC are provided to participants so they may understand their current strengths and development needs and formulate their future development plans. Apart from incorporating in-depth feedback, these developmental ACs sometimes incorporate some form of self-assessment (Wilson, 1996).

These centres use a variety of assessment techniques that provide participants with the opportunity to demonstrate essential job-related skills, abilities and competencies under standardised conditions (Kottke & Shultz, 1997; Sturre et al., 2011). Typical job-related skills and competencies include problem solving and analysis, written and oral communication, interpersonal skills and teamwork. While personal preferences and cognitive abilities of individuals can be embedded in the AC process, the main reason for the process is to obtain data from the use of behavioural-based exercises/simulations (Waldman & Korbar, 2004; Sturre et al., 2011). There are a variety of exercises including in-tray exercises, role-play exercises, analysis and presentation exercises and leaderless group discussions. Throughout the simulations, the performance of participants is observed and rated by assessors against the job competencies, providing accurate information on participants' behavioural competence (Woodruffe, 2007; Sturre et al., 2011).

In a recent study conducted by Sturre, Von Treuer and Keele (2011), knowledge of the results of the AC led to an improvement in students' performance. The benefits of the AC included the provision of feedback on students' assessment and identification of their development needs. While participants found the AC exercises to be difficult, there was a consensus among participants that they assess relevant competencies and are useful for their development (Howard, 1997; Keele, et al., 2010).

2.2. Goal-setting theory and its relevance to skill development

Goal-setting theory is based on Ryan's (1970) premise that conscious goals affect action. A goal is the object or aim of an action, for example, to attain a specific standard of proficiency, usually within a specified time limit. For goals to be effective, people need formative feedback that reveals progress in relation to their goals. If they do not know how they are doing, it is difficult or impossible for them to adjust the level or direction of their effort or to adjust their performance strategies to match what the goal requires.

Formative assessments or feedback – also called assessments for learning or learning-oriented assessments – are regarded as one means to facilitate learning and reflection in students (Webb, 2010). As some surveys have shown, students on placement regard deliberate and systematic reflection as integral to the learning process (Crebert et al., 2004). This reflection enables individuals to construct different mental models and optimise future responses to work problems (MacLellan, 2004). Formative assessments seem to speed up the development of capabilities that predict career success in the future, such as self-regulation, self-efficacy and lifelong learning skills (Yorke, 2005).

VandeWalle et al. (2001) conducted a study on the relationship between goal orientation and performance over a series of two challenging performance events. They found that, following feedback, only those subjects with a learning goal orientation performed positively at the next event. A learning goal orientation was defined as a focus on developing one's competence by acquiring new skills, mastering new situations and learning from experience. The findings of this and other research into goal-setting theory has significant implications for the skill development of graduates who participate in assessment centres and work placements, and who receive feedback as part of their development planning and monitoring.

2.3 Embedding an AC in curriculum

The impetus for this study derives from the results of a pilot study of an AC run in the faculty of Human Sciences PACE unit, FOHS300 in Session 1 2016. The study reported, through anecdotal evidence, students' enhanced capacity for self-reflection for assessing key employability skills, namely: communication, problem solving, influencing and negotiation, and collaboration. All PACE units require students to complete between 32-140 hrs of placement over one session (semester) unit. FOHS300 is a multi-disciplinary unit requiring 70 hrs on placement. The AC was designed to be implemented prior to students undertaking work placements, with the specific aim of designing goal-oriented development plans, to be actioned and monitored whilst on work placements.

An important aspect of curriculum design for experiential learning lies in the teaching framework developed to support student learning. Coulson & Harvey (2013, p. 404) contend "the need for scaffolding reflection for learning through experience as a process of layered learning interventions designed to encourage students to build their understanding, confidence, skill, and agency as they move into, through, and out of learning experiences that are set outside the formal academic setting". Scaffolding reflection in the unit content and delivery, facilitated and supported students' formative and summative learning, in the classroom, on placement and through assessment tasks.

The AC program was developed, coordinated and implemented by Masters of Organisational Psychology students at Macquarie University under the guidance of senior

academics. As assessors, the students undertook focus groups, utilising the Saville and Holdsworth (SHL) universal competency cards (SHL Group plc, 2004) to identify the behavioural competencies important for entry level social science graduates, specifically those mentioned above. Information from employer sources were also used as part of this process to establish a set of competencies that would be considered universally relevant and typical of those often found as entry level role requirements. Competencies needed to be generic due to group diversity in participant degrees and placement activities.

Students' competencies are evaluated using a range of approaches that gather data about their work-readiness. Students complete a pre and post 45 question employability survey collecting information about their self-efficacy in seeking employment information, their networks, agency and preparedness for employment. This data provides a baseline for students' work-readiness. At this stage base-line data does not include bias towards gender, employment experience, ethnicity, geographical location or age. Participants then complete an Assessment Centre, are given feedback about their performance, and development goals are set.

The Guidelines and Ethical Considerations for Assessment Center Operations informed the development of the exercises (International Taskforce on Assessment Centre Guidelines, 2009). Assessors created practical exercises and behavioural indicators to ensure depth of understanding and consistency in rating. Three exercises were developed to measure the competencies outlined, including a written task, a behavioural interview, and a group discussion. The exercises provide a realistic simulation of applied problems, such that taken together, they become a typical selection process for an entry-level role.

The AC runs in three-hour blocks, with up to six students assigned to a group. Six to seven assessors are assigned to the group, each interacting with two to three participants and rating different competencies. To reduce bias, assessors are assigned to an exercise, as well as rating different participants. On completion of the exercises, assessors undertake data integration, whereby competency scores are aggregated across exercises based on pooled information from assessors. A template report is populated with the data, which is used to provide feedback during an individualised goal setting discussion with participants.

Assessors conducted feedback sessions of approximately one hour with each participant individually. Each session provides students with an explanation of the competencies assessed within each activity undertaken, a debrief of the individual's performance, and an exploration of discovered strengths and areas for development. The discussion culminates in setting goals and the design of plans to target the development of relevant competencies. Plans are documented in a report, which is given to the student. While the AC is not assessed, students collect evidence of achievement of their goals whilst on placement, write a reflection and analysis based on the evidence, which is then assessed.

An ethics agreement for this research is current, however, due to ethical considerations involving perceived coercion, consent to collect the data can only occur once students have completed the unit and all assessments are marked. Given the unit is running till the end of January, data collection will not be finalised to late February, with analysis occurring subsequently. Survey information will be aggregated and grouped under the constructs: self-efficacy, positivity, professional industry networks, employability self-awareness, communicating with people (in business contexts), resilience, and job seeking skills. As we want to ascertain which, or indeed if any, of these constructs were more influenced than others as a result of the AC and internship process, across-group and within-group comparisons will be analysed.

3. Conclusion

The review of the research literature indicates the importance of developing the employability skills of future graduates. It provides strong evidence of the effectiveness of work-integrated learning practices (particularly work placements) in developing these skills. Additionally, the evidence suggests the need for systematically assessing the skills, competencies and behaviours of undergraduates for development purposes. It also supports the need for ongoing feedback and critical reflection on students' progress towards development goals, and it recognises the importance of students adopting a learning goal orientation to maximise the benefit of their experience.

The AC model presents a process methodology for assisting students in achieving a set of developmental competencies that support learning for employment. The research and evaluation findings, on the efficacy of the model, will be available when the data is collected and analysed.

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A Transformative Approach to Social Work Education

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Abstract

The paper presents an overview of “The Journey Guides Program” - a mentorship and experiential learning framework developed by the Faculty of Social Work, University of Calgary in Canada. This program was implemented in an Advanced Graduate Seminar, a preparatory course for graduate Social Work students prior to entering their field placements. The purpose of this program is to advance practice-based knowledge in transformative learning. This article begins by discussing critical pedagogy, the theoretical framework that underpinned “The Journey Guides Program”, followed by a description of the eight-step process the authors adopted to implement this program. This paper concludes by presenting our evaluation plan and subsequent steps.

Keywords: *Journey guides; transformative learning; mentorship; social work.*

1. Introduction/Background

Social work is a transformative profession that centralizes human rights and social justice work (International Federation of Social Workers, 2012). Social work students require transformative learning opportunities to engage them in a process of critical thinking to “expand consciousness through the transformation of basic worldview and specific capacities of the self” (Elias, 1997, p. 3). Critical pedagogy resonates with social work education as it is intended to “provoke the student to question all taken-for-granted values, ideas, norms, beliefs, etc. of her experience that are the given presuppositions comprising the dominant social paradigm” (Sagris, 2008, p. 1). In order to centralize transformative experiential learning in social work education, the University of Calgary’s Faculty of Social Work developed a community mentors experiential learning framework entitled the “Journey Guides Program”. This initiative was implemented in an advanced graduate seminar for students pursuing a specialization in international and community development. The seminar focuses on preparing graduate students to enter field placements in both local and international settings. This paper presents the theoretical lens that informed the initiative, the eight-step experiential framework that was used as a pedagogical tool to support student learning, and the preliminary plans for program evaluation. The purpose of the program is to advance research-informed teaching in the area of transformative learning.

2. Literature Overview

Essential competencies and skills required for the profession of social work include critical analysis, leadership, and actions to address and eliminate oppressive social and economic conditions (CASW, 2015). Increasingly, there is growing recognition of the importance of better preparing social work students to engage in critical and anti-oppressive practice (Dominelli, 2002; Fook, 2002; Mullaly, 2010). Transformative learning is an important tool to achieve this goal as it aims to assist students to develop autonomous thinking and question prevailing 'truths' (Mezirow, 1997; Bay & Macfarlane, 2011). This is important to social work, which is a practice-based discipline, as research indicates that “experiential learning can serve as a vehicle to encourage students to become engaged citizens” (Heinrich, Habron, Johnson, & Goralnik, 2015, p.273). While the literature suggests that experiential learning opportunities can promote transformative learning, “critical thinking is not necessarily a part of every experiential learning process” (Heinrich et al., 2015, p.273) and needs to be articulated as a key outcome. The capacity for critical thinking is particularly important to social work, and “educators are responsible for assisting students to develop their critically reflective capacity” (Bay & Macfarlane, 2011, p.755). Community mentors or guides can assist students to navigate experiential learning endeavors. Scholars expound the benefits of mentorship, which is both relational and

experiential, in providing students with professional knowledge, skill-building opportunities, connections, and guidance (Schweibert, 2000). For example, a study by Venema, Ravenhorst Meerman, and Hossink (2015), note that connections with community-based practitioners enhanced student learning. There is limited research, however, on the role of mentorship and experiential activities in supporting transformative learning in social work education. Additionally, the impact of community-based experiential opportunities requires further research. Few studies have adopted critical pedagogical and transformative learning approaches to meet this objective. The Journey Guides Program sought to fill this gap in social work education by implementing and evaluating an experiential transformative learning framework, which included a mentorship component.

3. Theoretical Lens and Rationale

The Journey Guides Program was established as an experiential and relational learning initiative for graduate students. The purpose of the project is to advance teaching knowledge in transformative learning. The authors utilized our collective experiences of more than eighty years of practice and teaching to design the program. Our team included two instructors in the specified graduate program, an alumni, an experienced community organizer and an expert in mentorship research. An essential element of the program, community-based practitioners involved in social justice work were recruited as “Journey Guides” to provide one-to-one mentorship and support to students. Journey Guides were defined for this project as: *social workers (or related professionals) with community organizing experience and cultural knowledge related to a student’s potential or selected practice region or population.*

Specific program goals were established: 1) enhance knowledge, experiences and competencies of students in community development practice; 2) promote experiential learning opportunities for students through critical dialogues and actions; 3) build students’ personal and professional networks; 4) help students recognize their aspirations and choose potential field placements; and 5) assist students to develop an interest in mentorship as a social work practice. With these aims, an eight-step process was established is presented in the following section.

4. Implementation of the Program

Building on the project rationale and the transformative learning goals discussed in the previous section, an eight-step program implementation process was developed. The steps were implemented in Year 1 and will be modified based on the findings from our program evaluation. (See Figure 1). Sixteen graduate students and eighteen Guides participated in the Journey Guides Program in Year 1. The Guides' involvement in this program was completely voluntarily and they did not receive remuneration.

4.1 Step 1: Community supper

At the beginning of the term, both students and Journey Guides were invited to participate in a "community supper" in the Faculty of Social Work in order to set the context for the year-long relationship among Guides, students and course instructors. This community event contained key elements such as networking opportunities, motivational presentations from Guides on local and global social justice issues, and the sharing of a meal. This first event underscored the importance of relational learning and the value of community-based experiences. It also centralized social justice while at the same time offering an ambience with music and enjoyment.

4.2 Step 2: Aspirations assignment

Students were asked to complete an "Aspirations Assignment" and deliver a two-minute "Elevator Speech" to their peers and the course instructors. This assignment helped them to reflect on their goals and plans for the year related to their graduate program and assisted the instructors to match each student with a Guide.

4.3 Step 3: World Café Exchange

A World Café event (Brown, 2001) was organized for both students and Guides that focused on relationship-building and knowledge exchange. From this event, a number of relationships were formed and students were able to acquire practical knowledge from experienced practitioners.

4.4 Step 4: Matching process

Each student was matched with a Guide based on their Aspirations Assignments and recommendations that emerged from the two experiential activities (supper and World Café). Students were provided with their Guide's profile. An introduction letter was sent to both students and Guides to complete the match.

4.5 Step 5: Agreement

During the matching process, an "Agreement Letter" was distributed to students and Guides to facilitate the first meeting. The agreement was developed from existing research in the area of mentorship, and focused on purpose, expectations, respect and professional boundaries. Each Guide committed to meeting with a graduate student for a minimum of three times throughout the year, and many attended class gatherings and subsequent events.

4.6 Step 6: Mentorship workshop for both students and Journey Guides

Recognizing the need for mentorship training, two mentorship training workshops were offered for both Guides and students. The workshop provided participants with an opportunity to gain a better understanding of mentor/mentee roles and also helped them to reflect on their respective roles.

4.7 Step 7: Mentorship meet-ups

Guides and students were asked to arrange an initial meeting within the first six weeks of the program and second and third meetings at the mid-point and end of the course. Students were required to prepare questions for their Guides and classtime was used to plan for these meetings.

4.8 Step 8: Feedback loops and further meetings

Feedback on the program was elicited from students during classroom discussions. Instructors facilitated ongoing communication with the Guides through email and invitations to attend specific class events and activities.

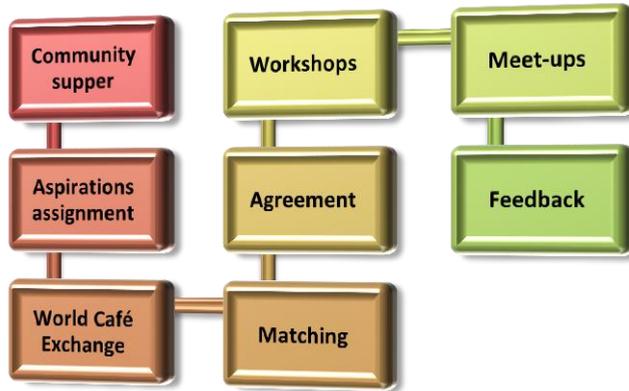


Figure 1. Implementation of the Program

5. Evaluation Method

Following the first year of program implementation, the authors designed an evaluation plan to assess the benefits and challenges of the program. The research, currently underway, employs a mixed-method design over a two year period. This includes focus groups with both students and Journey Guides from Year 1 and 2. An online survey is also distributed to students upon the completion of their study program. Our plan is to evaluate the impact of this experiential learning process (with cohort 1), refine our framework, and implement and evaluate it with the second cohort of students. Key concepts assessed through this evaluation include the student's understanding of their roles in social work, in community organizing and as advocates for social justice. A three-phase process of thematic analysis (Guest, 2012) will be used to analyze the data from Year 1 and 2. The evaluation is funded through a Teaching and Learning Grant provided by the Taylor Institute for Teaching and Learning at the University of Calgary.

6. Discussion and Implications

The profession of social work is founded on the tenets of social justice and human rights. In a world with high levels of inequality, violence and ecological harm, there is an increasing call within social work to centralize these core ethical concepts in ways that produce tangible outcomes. As a response to the need for transformative learning within social work, a critical pedagogical lens was used to design a transformative experiential learning initiative for graduate social work students. Through the implementation of this program, students were provided with opportunities to engage with community Guides and participate in community-based experiential activities. An evaluation of this program is currently underway, guided by an interdisciplinary research team, including the two course

instructors who were involved in the program's design. The findings will centralize concepts that are of key importance to social work, including the student's ability to expand their networks of influence and their roles as social justice advocates.

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Students' surveys and involvement in educational activities within virtual environments are related to students' satisfaction in e-learning graduate programs

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Abstract

This paper evaluates associations across the dimensions included in students' surveys and virtual activities for applying educational models within e-learning graduate programs. Firstly, we focus on the outcomes derived from teachers' and students' participation in virtual classroom forums and, secondly, on the determinants of students' satisfaction in the graduate program. Data analyses show that teachers' and students' participation in forums as dynamic educational activities are positively correlated with students' general satisfaction. To study the determinants of students' satisfaction, we perform a regression analysis that considers as explanatory variables educational planning, teaching qualifications and development of learning, as well as of a number of controls related to the virtual learning environment and participation in the academic program. According to the obtained results, teaching skills and learning environments are associated with higher students' satisfaction in a virtual learning environment. This type of analysis is of great interest in a social environment characterized by increasing communication via electronic networking. We find that dynamic educational activities and dimensions taken on board on students' surveys are related to students' satisfaction in e-learning graduate programs.

Keywords: *e-learning; educational model; student survey; forums; students' satisfaction; graduate program.*

1. Introduction

The potentiality of virtual learning environments (VLEs) to develop higher education students' competencies and knowledge might be associated to the changes that are being experienced worldwide with the development of the so-called *network society* (see Castells, 2010 and 2016; and Márquez-Ramos & Mourelle, 2017). As it occurs in traditional learning environments, evaluation systems in VLEs involving lecturers' performance are a tool for universities to evaluate the degree of compliance of their lecturers. These evaluation systems are included in more general evaluation of educational models applied in universities. Evaluation models generally include some of the questions or dimensions included in students' surveys, based on the idea that students learn more from highly rated lecturers (Uttl, White, Wong-Gonzalez, 2016). This fact determines that models that support management teaching quality systems have their base on the satisfaction of requirements and expectations of actual and potential users (e.g., students...) (Duart & Martínez, 2001).

In this study, we analyze the relationship between the organization of the teaching process in virtual conditions and the dimensions of the assessment carried out by the students. To do so, we focus on the DOCENTIA-UJI model that involves four dimensions included in the students' survey as an evaluation system for lecturers' performances (see <http://www.uji.es/serveis/opaq/base/gestio-qualitat/aval-doc/docentia/> for a detailed description). In VLEs contexts, lecturers are not a content transmitter, but a learning environment designer. They have to join students, who are the protagonists of the learning process, creating a climate of interest and giving autonomy in all this process (Bautista, 2011). The student has to maintain an active attitude in her interaction with others (lecturer or other students) being competent in a relational level (Sancho & Borges, 2011).

As Laurillard (2002) reported, the VLEs can support different media forms of learning technologies that could alter the educational environment: narrative media for attending and apprehending, interactive media for investigating and exploring, communicative media for discussing and debating, adaptive media for experimenting and practicing, and productive media for expressing and presenting. However, VLEs are principally focused in narrative and interactive media (Lameras et al., 2012), but not other media that involve different degrees of dynamism (as chats or forums). Thus, there are a lot of studies that show contradictory results regarding student satisfaction and performance in VLEs (Stöhr, Demazière, Adawi, 2016). This study may serve to provide empirical evidence in an e-learning graduate program, which can be interpreted in the context of the effectiveness of the teaching process. The aim of our study was to study how students' survey dimensions on lecturers compliance were related to communicative media in a VLE.

2. Methodology

In this study we recruited the Lectures Evaluation system for students from an e-learning graduate program at the Universitat Jaume I (UJI). In total, 12 different subjects and 25 different teachers were evaluated for a mean sample of 10.41 (SD±1.84) evaluations per subject. Mean number of students per subject was 33.73 (SD±0.84).

Lectures Evaluation System involves four indexes used for the DOCENTIA-UJI model, which has been referred in the Introduction section. These indexes are called: D1, Educational Planning; D2, Teaching Qualifications; D3, Development of Learning; D4, General Satisfaction. Moreover, we extracted a fifth index called Degree of Compliance, D5. Each of these indexes are evaluated by asking from four to one different questions in a 5 point-Likert scale. Table 1 summarizes the questions for each index.

TABLE 1. Evaluation indexes of the Lectures Evaluation System.

D1	Educational Planning
Q1	At the beginning of the course or program I have a clear guide to the subject
Q2	In this subject I always know what the assessment criteria are going to be used
Q3	The course materials (books, notes, etc.) included in the program or the subject are adequate
Q4	The teacher meets the subject's program
D2	Teaching Qualifications
Q1	The teacher is clear in the explanations
Q2	The teacher achieves students' participation
Q3	The teacher's communication skills facilitates my learning process
Q4	The teacher maintains an adequate learning climate
D3	Development of Learning
Q1	The amount of work required is proportional to the credits of the course
Q2	The teacher applies appropriate methodologies and resources
Q3	I find the aid received in tutorials (in-person and/or virtual) effective to learn
Q4	Continuous assessment activities are adequate
D4	General Satisfaction
Q1	In general, I am satisfied with the teacher of this subject
D5	Degree of Compliance
Q1	The teacher has facilitated my learning, broadening my knowledge and improving my skills
Q2	I have improved my skills according to the expected competencies detailed in the program of the subject

The development of communicative media within the virtual classroom were measured as different variables related with the development of forums. Forums in e-learning allow students to connect and collaborate in virtual environments, making them an ideal addition to both asynchronous and synchronous instructional strategies. We measured four different variables related to lecturers' forum activity: number of open forums; number of lecturers' participations in forums; total number of characters entries in forums; and total number of forums entries including students and lecturers (see Table 2). Furthermore, we controlled for the number of times and total time lecturers connected to the virtual classroom (see Table 2). It should be noticed that the number of participants for each lecturers' evaluation ranged from 14 to 7 students within subjects, in which between 33 to 31 students were enrolled and, therefore, students' participation in survey ranged between 45 to 22 percent per lecturer.

3. Analyses and Results

As we can see in table 2, the means of the dimensions score-related are above 4.47 points. In the analysis of the association between the dimensions of the educational model and the participation in forums we excluded three lecturers that were not involved in forums development at all. Then, a bivariate correlation analysis showed a positive correlation between the total number of forums' entries including lecturers and students, and the D4 General Satisfaction ($r(26)=0.46$, two-sided $p=0.02$). However, number of open forums for each lecturer or their individual participation in each forum in terms of entries or characters were not significantly correlated with any educational model dimension. Likewise, lecturers' connections to the virtual classroom in terms of entries or time in seconds did not correlate significantly to any model dimension, or any other variable.

Furthermore, the association between the total number of forum participations and D4 General Satisfaction remained significant ($r(22)=0.42$; two-sided $p=0.04$) after partial correlation with the number of open forums by each lecturer.

TABLE 2: Mean (SD) and range interval for dimension and lecturers' forum activity- related variables

	Mean (SD)	Min-Max Range
D1	4.62 (0.03)	4.56-4.68
D2	4.61 (0.03)	4.56-4.68
D3	4.49(0.05)	4.46-4.66
D4	4.64 (0.03)	4.57-4.69
D5	4.63 (0.12)	4.50-5.00
Number of open forums	1.23(0.99)	0-5
Number of lecturers' participations in forums	13.15 (12.92)	0-54
Total number of characters entries in forums	13196.46 (13273.51)	0-57799
Total number of forums entries (including students)	77.62 (35.89)	33-135
Virtual classroom entries	31.85 (19.72)	1-67
Time at virtual classroom (in secs.)	72931.65 (64896.66)	187-278554.
Number of students	33.73 (0.83)	32-35
Lecturers' ECTS*	1.52 (0.85)	1-4

*European Credit Transfer and Accumulation System

In our second analysis, we focused on what other dimension included in students surveys related to the general satisfaction of the students including all lecturers. For the analysis of these associations, we performed a regression analysis and looked into the determinants of the indicator D4 (in logs), i.e., the indicator that proxies for general satisfaction. On the other hand, we considered as explanatory variables the perceived values and experience of lecturers, which we proxy alternatively by using the previously introduced indicators D1, D2 and D3. In this regression analysis, we included D1, D2 and D3 (in logs) separately in every regression to avoid multicollinearity problems. Secondly, we included as explanatory variables the controls related to the communicative media in the virtual environment and academic program's variables such as number of ECTS. Specifically, these controls were 1) the total number of forums per subject, 2) the number of forums per lecturer, 3) the number of times that the lecturer participates in forums, 4) the number of characters in lecturers' participations, 5) the total number of entries in the forums by lecturers and students, 6) the number of connections by the lecturers, 7) the lecturer's connected time, 8) the number of students, and 9) the number of credits (ECTS; European Credit Transfer and Accumulation System) that the lecturer teaches in the virtual environment.

The goodness of fit of the three estimated models was good, as it varied between 66 and 71.2 per cent. The obtained results¹ showed that the estimated coefficients for D1, D2 and D3 were positive signed and statistically significant and then, when these indicators increase, also do so the general satisfaction of the students enrolled in the academic program.

This result is complemented by looking at beta coefficients, which are used to compare the magnitude of the estimated coefficients obtained in the regression analysis of those variables measured using different scales. The highest beta coefficients obtained are for Teaching Qualifications, D2, followed by Development of Learning, D3. These results show that all dimensions included in educational models are related to general satisfaction to a different degree. Particularly, teacher skills and learning environments strongly matter for students' general satisfaction in a virtual learning environment.

4. Discussion

In this study we analyzed the association between educational model dimensions and lecturers' development of communicative media of dynamic forums in a virtual classroom for an e-learning graduate program. Interestingly, model dimension D4 General Satisfaction was directly related to a measure that sums up lecturers and students participation in virtual forums. Moreover, Teaching Qualifications and Development of Learning dimensions are related to general satisfaction of students. Therefore, we can conclude that general satisfaction with e-learning graduate programs are related to lecturers and students involvement in their dynamic educational activities, as well as surveyed teacher skills, and learning environments are directly related to general satisfaction.

It is important to create virtual environments where students can construct by themselves their own knowledge and lecturers provide guidance. It is fundamental to think about how to provide students the tools to develop the scaffold that supports learning (Stöhr et al., 2016). Nevertheless, as previous studies report (Maarop and Embi, 2016), despite lecturers could be able to develop good designs, they need institutional support to find the right balance between student autonomy and lecturer-student interaction (considering the ratio presentality/virtuality: classroom, online and blended teaching).

Interestingly, our results may be considered under the recent meta-analysis published by Uttl et al. (2016), in which authors show that faculty teaching effectiveness is not related to ratings from student survey of teaching. Thus, we showed that general satisfaction in

¹ Full results are available upon request.

student surveys were related to other evaluated dimensions linked to teachers' skills and learning environment, as well as to student and teachers involvement in communicative media within the virtual environment. However, all these measures have nothing to say related to lecturers' effectiveness on students learning or career success. Our results restrict to students' learning experience and involvement on virtual environments. Therefore, the involvement of students in dynamic activities, such as forums within virtual environments, favor a higher general satisfaction with lecturers. Furthermore, we observed that the general satisfaction of students were related to their subjective perceptions of lecturers' skills, and the learning activities developed by lecturers. In this sense, we may question whether any of these dimensions are independent or they are reflecting the same effect on students' satisfaction.

Finally, our research scope is bounded by study limitations. First, the sample size that completed the survey was small and, therefore, results should be cautiously considered given that they are underpowered. Second, the questions that evaluate each dimension and the dimensions themselves may be adjusted to the DOCENTIA-UJI model. However, this model is addressed to the evaluation of both virtual and present educational environments, and this model needs to be validated for a virtual environment. It is worth mentioning that, although the research has been carried out on a small sample and the results should be drawn carefully, this study provides a solid basis for further research.

5. Conclusion

The aim of our study was to test the association of different variables and students' survey dimensions related to lecturers' compliance in a virtual environment during the development of an e-learning graduate program. We were interested in showing whether dynamic activities, such as lecturers' forums activity, were related to the dimensions evaluated within the educational model of the university (students' satisfaction principally). Moreover, we wanted to see the association between the dimensions included in the educational model, independently of teachers and students involvement in the virtual environment. For this purpose we performed multivariate analyses. We found that both students and lecturers involvement in educational activities, as well as students subjective perception of teacher skills and educational environment, relate to the dimension of students' general satisfaction. We suggest the development of specific students' surveys on lecturers' educational abilities in order to validate the evaluation of e-learning activities in virtual classrooms. Objective measures of students and teachers' involvement in dynamic activities may serve as indicators of general satisfaction too.

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Development of tools for internal control and leadership recognition in working groups

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Abstract

This paper presents the state of teaching experience conducted during the last seven years by a group of teachers. These professors simultaneously teach five subjects in the framework of the EHEA of the Degree of Engineering of Industrial Design and Product Development at the University of Zaragoza.

The applied teaching methodology includes guarantee of teaching quality and learning system based on series of indicators that have been defined and improved over the years. This document reflects the results of the module work during the last academic year 2015-2016, during which the follow-up of group work has been implemented based on meeting records of the group meetings. In these meeting records the students have reflected the evolution of their work and the agreements taken, being supervised regularly by the teachers. As a result of this action, a substantial improvement has been achieved in the functioning of working groups that, due to their particular circumstances, could be problematic, allowing the teaching team greater control of internal conflicts. Additionally, the system also serves a second objective: fostering leadership in the group by rewarding the individual final grade for proactive behavior and punishing dishonest behaviors among peers.

Keywords: *modular teaching; quality guarantee; continuous improvement in teaching and learning; collaborative learning; project-based learning.*

1. Introduction

From the academic year 2009-2010 to the present, within the framework of the EHEA of the Degree of Engineering of Industrial Design and Product Development at the University of Zaragoza, the group of professors who teach the five subjects (Creativity, Graphic Design and Communication, Statistics, Electricity and Economic Aspects) simultaneously, with the same group of students of the second year and second semester teaching period, has been applying a system of quality guarantee for teaching and learning. This teaching team has since then developed the work methodology by modules (Agudo *et al.*, 2011; Miralves *et al.*, 2011; Manchado y López, 2012; López y Manchado, 2013; Serrano *et al.*, 2013) in order to obtain a more practical training, thus promoting students learning. This work basically consists of a module project (MP) in which the group of four or five students must integrate the multidisciplinary knowledge of the five subjects of the semester, taking into account that they must achieve global objectives of the work as well as individual objectives of the respective subjects (Agudo *et al.*, 2011). The overall objective of the project is to prepare the student for the professional reality he/she will face at the end of his/her studies (López and Manchado, 2013). Because it is in the working world where this capacity of coordination of the different areas of the company and its integration in a common work is demanded.

The developed principles of all the work are based on Project-Based Learning (PBL) and Collaborative Learning (CL) (Bará J., Domingo J. and Valero M. 2009; Bará J., Ruiz S. and Valero M. 2009; Bouhuijs PAJ, 2011; Herreroeder IA, 2013). Based on basic specifications of a common product to all groups and previously established by the teaching team, students must design and launch a new product to the market and in order to do it they develop a series of activities that they organize, program and supervise with the help of the team of teachers. The goal, as if it were a real business environment, is the development of a new product and its placing on the market with all that it entails.

The applied teaching methodology is based on the philosophy of continuous improvement, contemplating a series of indicators that have been defined and improved throughout all these years.

The indicators finally obtained correspond to the competences that must be acquired in the different subjects. In particular, they allow the evaluation of coordination and group work, the management of information, the evolution of its capacity for analysis and synthesis, as well as the ability to solve problems, concern for quality and general satisfaction. It also provides information on time management in the distribution of tasks throughout the project, the balance of requirements between subjects or coordination between teachers.

This system of quality guarantee in imparted teaching is annually reviewed by the team of teachers, establishing corrective actions based on the intended initial objectives. Past

examples of these improvements have been: the joint evaluation of the work by teachers with established rubrics, the incorporation of external support staff to the evaluations, the self-assessment of the individual's contributions to the group, the penalty/bonus for the established deadlines accomplishment, etc.

All this has been carried out under the cover of the University of Zaragoza Teaching Innovation Projects in which the team has participated: PIIDUZ_09_3_127 / PIIDUZ_10_3_438 / PIIDUZ_11_3_482 / PIIDUZ_14_073 / PIIDUZ_14_069.

2. Objectives of the study

Although the technical quality of the module works evaluated by the team of teachers was very satisfactory, and even slightly increasing each year, the teaching team considered that it was time to make a qualitative leap and start to strengthen first, and then reward other fundamental aspects in the working world. Thus, as a result of the last revision of the system of quality guarantee in teaching and learning carried out in the past academic year 2015-2016, the teaching team decided to address two general objectives that remained unresolved until the date:

1st. Regarding the operation of the group:

Until 2015-2016 there was an evident area of improvement in the case of those groups that by their particular circumstances ended up developing internal conflicts that clearly affected their performance. The problem used to be difficult to find on time by the teaching team, since it was normally concealed by the members of the team until the internal coexistence became untenable or until the problem was manifested with a poor performance of the group being unable to present the complete work or qualified as ineligible.

2nd In relation to the recognition of individual internal work in the group:

For the teaching team there was another area that could be improved: rewarding the individual effort. In some groups there were people who clearly contributed with much less work than the average, and other people contributed with much more work than the average, being finally compensated all the people of the group with the same note. Which was not fair from the point of view of the teaching team.

In order to address these two areas of improvement in particular, the actions that were eventually developed respectively and in addition to the work that has been carried out, the decision was taken for the previous course of:

1st To implement a system of internal self-control on the operation of the group based on work meetings every two weeks made by the students. The results of these meetings should

be reflected in meeting records in order to allow the teaching team to see their work evolution as well as to detect conflicts between members.

2nd To implement a system as objective as possible to reward the proactive behaviors and the leadership exercised by the students. This system is based on the information provided by the internal meeting records of the group, the individual surveys carried out by the team members and the perception of the team of teachers. The ultimate goal is to reward the work of team leaders through the score, as well as to punish the dishonest behavior of those members who did not cooperate in achieving the team's goals.

3. Developed fieldwork

The first week of the 15 that constitute the semester all the students of 2nd grade and 2nd semester of the Degree in Engineering of of Industrial Design were distributed in working groups of 4 or 5 members to develop the MP. This MP consisted on the realization of a device for mental training. The 17 resulting groups were distributed among the members of the teaching team to be tutored more directly and personally.

Already in that first week the different teams of work carried out a meeting record of constitution of the team named denominates "Acta Cero" ("Zero Meeting Record"). The meeting records established the basis of the work or operating rules agreed by the team and the planning of activities for the whole term, both the MP and the subject (Market, Enterprise, Technology, Innovation and Communication). This meeting record, like the rest, that were later elaborated, was hung with the periodicity established in the teaching digital platform, in order to be supervised by the assigned tutor.

As already mentioned above, after the initial meeting records and every two weeks the different groups were elaborating 4 follow-up meeting records of the work done including the following points:

1. Degree of overall progress of the MP in percentage.
2. Degree of progress of each one of the areas or subjects in percentage.
3. Degree in which the knowledge of the 5 subjects has been integrated and related.
4. Degree of overall satisfaction with the development of the MP.
5. Degree of individual satisfaction with the development of the MP.
6. Individual assessment of the progress of work.
7. Need for an interview with the tutor / teaching team (optional).

Prior to the final presentation of the MP the group made the "Final Meeting Record" with an overall assessment of the MP. All of the above was especially supervised by the teacher-tutor responsible for the group as well as the rest of the team of teachers.

After the public presentation of the works to the teaching team, the final assessment surveys and the individual contribution sheet fulfilled by the students, the teaching team made the assessment of the joint work of the different groups of students.

4. Results

The results finally obtained in relation to the internal functioning of the group, through the implementation of the system of internal self-control by the meeting records to be carried out on the work meetings every two weeks by the students, were the following:

- The meeting records done seemed to be generally agreed upon by team members and did not show that there were any problems. This might be probably true in most cases, but based on the previous experiences, it is quite possibly that the students, as colleagues, try to solve their problems internally rather than manifest them to the teaching team.
- There have been a number of problems in meeting delivery dates, especially due to the lack of attention of some groups. In some cases they were presented outside the system and in many others were not presented (which may indicate the existence of an internal problem). Although the records have served to take control, this has not been to the extent that the teaching team expected due to the problem described in the previous point. The first meeting record of constitution was made by all the groups (although two did it outside the system), but progressively and especially from the 3rd meeting record it was no longer answered by numerous groups. Of the 17 existing groups, they are only considered 16 for study purposes. Only 3 of the groups have answered all the acts. Table 1 shown below summarizes the general results, the number of responses obtained from within the system, not those carried out outside the system, as well as the degree of progress in the MP module work or in the several subjects.
- There seems to be a clear overall trend about the satisfaction shown by members of the different groups. In the first meeting records, they appear to be more demanding with the module project appearing numerous cases of people who say they are "neither satisfied nor dissatisfied" evolving to a greater presence of "somewhat satisfied" and "very satisfied" in the end.

MEETING RECORDS	ANSWERS		PROGRESS				
	Nº	%	MAR-KET	ENTER-PRISE	TECHNO-LOGY	COMUNI-CATION	INNOVA-TION
0	15	93,7					
1	15	93,7	61,33	29,33	10,67	2,67	11,67
2	14	87,5	89,29	48,57	25,36	23,21	45,36
3	14	87,5	79,29	50,36	20	25,71	67,86
4	9	56,2	88,33	56,67	29,44	42,78	75,56
5	6	37,5	94,17	52,5	56,67	59,17	83,33

Table 1. Acts prepared by groups of students

- About the usefulness of the system of the meeting records by the students, this year four questions were included in the final anonymous survey carried out on the module work. The results are shown in the following graph, which are evaluated on a scale of 1 to 7, with 1 being "Totally disagree" and 7 "Totally agree" (see figure 1).

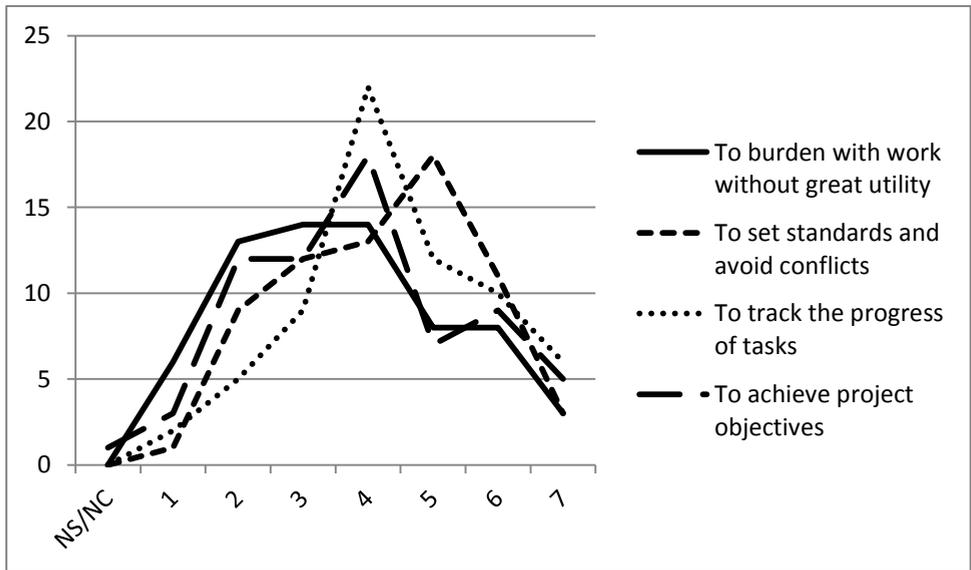


Figure 1: Assessment of the meeting record system by students

It can be seen that in general the students consider that the meeting records did not serve to load them of work without utility, but especially to establish the norms of the group and to avoid conflicts. Taking an intermediate position, the evaluation of the system to monitor the progress of work or achieve the objectives of the project. In relation to the recognition of individual leadership by establishing a system as

objective as possible to reward the leadership exercised by students or punish dishonest behavior, this time has there was no need to apply it. Analyzing the information provided by the internal group meeting records, the individual surveys carried out by the different team members, the assessment sheet of the individual work, as well as the perception of the team of teachers, no significant cases were detected to be awarded as well as serious operating problems that deserve to be punished as dishonest behavior.

5. Conclusions with pedagogical implications and continuity

- Although it may be due to various causes, not attributable solely to the meeting record system with the planning carried out by the various groups, during the last year all 16 teams have completed the work satisfactorily in the advance examination call, with no fails as on previous occasions. Nonetheless, further work should be done to reduce the two peaks of work through planning that continue to be manifested. Similarly to the previous one, possibly due to various causes not attributable solely to the performance of the meeting records, this year there have been no serious operating problems that required the intervention of the teaching team. Neither dishonest behavior among colleagues of the same team has been detected.

Regarding the continuity of the project, the teaching team has taken the following agreements:

- To continue the following year with the system of meeting records reducing the number of the current 6 to 4 (constitution, prior to the intermediate presentation, agreements taken after the intermediate and final presentation).
- To give the meeting record a greater utility in piloting the groups and be more demanding in their implementation. Failure to submit them will prevent the submission of intermediate and final work.
- To continue with the improvement of the application of meeting records loading system, tutoring by responsible teacher, to extract answers to Excel and to visualize and analyze them.
- To add in the final survey a question on the individual assessment: Does it seem fair to you that all members of the group have the same grade? To which students must answer "Yes" or "No". In the case of answering "No" the student must propose a distribution of the score.
- To continue to study rewarding of the individual leadership through note. To do this, we are working on a system that is as objective as possible, by means of an algorithm that allows us to propose a distribution of the note.

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The influence of competences in business higher education: a student's approach

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Abstract

Nowadays, competences have an important role in higher education. Their development may have an effect on student's satisfaction with his/her studies. The aim of this research is to test the relationship between competences developed during the study of a university business degree and the student's satisfaction with this degree. Moreover, we test other outcomes derived from satisfaction, such as the student's word of mouth and his/her confirmation of the university degree that he/she chose. We design an online survey for students of the Faculty of Economics and Business Administration in a Spanish University. We collect 161 effective questionnaires and analyse them using structural equation modelling, specifically partial least square (PLS). Results demonstrate that competences have a strong effect on student's satisfaction, leading to positive word of mouth and confirmation of student's past behaviour. This implies that specifying and working properly the competences of a degree becomes a priority objective for university institutions.

Keywords: *Competences; Satisfaction; Word of mouth; Behavioural confirmation.*

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1. Introduction

In recent years, one of the major changes that has occurred in the context of higher education has been to focus on the acquisition of competences by students. The project “Tuning Educational Structures in Europe” highlights the concept of competence as the ability of a person to perform certain issues related to knowledge, applications or attitudes. Competences are categorized into subject-specific and general-academic. While subject-specific competences depend on the area or subject, general-academic competences are multidisciplinary, so they can be considered as transversal competences (Parvu *et al.*, 2014). Therefore, general competences allow the comparison between students with different educational profiles, and can be seen as a minimum necessary for the adequate incorporation of postgraduates into the labour market.

General-academic competences are usually classified into three groups: instrumental, interpersonal and systemic. Instrumental competences are characterized by cognitive, methodological, technological and linguistic abilities. These include aspects such as the individual’s ability to analyse and synthesize, to learn foreign languages, or to make decisions. Interpersonal competences refer to individual abilities like social skills (social interaction, ethical commitment and co-operation). Finally, systemic competences are focused on the student’s abilities concerning whole systems, such as combination of understanding, sensibility and knowledge.

Competences have attracted the attention of researchers due to their importance in higher education. Several works have tried to determine what tools promote the individuals’ acquisition of competences and have addressed the analysis of competences and skills according to the area of study (Sanahuja *et al.*, 2016; Weinstein, 2016). Moreover, other authors have tested the evaluation that recent postgraduates carry out about the competences acquired to develop the career that they want to perform (Azevedo *et al.*, 2012). The relationship between the development of competences and the student’s satisfaction with his/her education demands higher attention, especially whether we take into account that the individual’s satisfaction diminishes the dropout rate (e.g., Duque, 2014; Gairín *et al.*, 2014). In this context, a relevant topic that deserves more attention would be the influence of competences on the overall individual’s satisfaction with his/her studies (Azevedo *et al.*, 2008).

The aim of the present research is to establish the relationship between competences developed during the study of a business university degree and the student’s satisfaction with this degree. Moreover, this research addresses other outcomes derived from satisfaction that have been hardly tested, such as the student’s recommendations (i.e., word of mouth) and his/her confirmation of the university degree that he/she chose. Nowadays, the analysis of these relationships is essential because the total implementation of the

degrees is ending and universities should know the student's evaluations. Our study allows us to draw conclusions about the importance of the competences developed, in order to improve the degrees.

This research is structured as follows: Section 2 formulates the conceptual model and proposes hypotheses. Section 3 explains the methodology applied and section 4 exposes findings. Finally, conclusions and implications are described.

2. Conceptual model and hypotheses

Student's satisfaction depends on the academic achievements that he/she has obtained, not only in terms of scores but also related to his/her learning performance (Wilkins *et al.*, 2016). Precisely, the concepts of learning, ability, capacity and skill are those that support the idea of competences. Recent works have shown that competences developed through specific subjects (e.g., related to marketing) have a significant influence on student's satisfaction with these subjects (De Juan-Vigaray and González-Gascón, 2013; Orús *et al.*, 2016). Therefore, our first hypotheses highlight this relationship for university degrees:

H1. The development of competences in a university degree positively influences the student's satisfaction with this degree.

Several studies have demonstrated that recommendations (e.g., word of mouth) and the intention to confirm a particular behaviour are outcomes of the individual's satisfaction (e.g., Vila-López and Küster-Boluda, 2016). In the educational field, satisfaction is considered a strong determinant of loyalty, the latter being measured as the conjunction of the student's recommendations and intentions to repeat his/her behaviour (Brown and Mazzarol, 2009; De Juan-Vigaray and González-Gascón, 2013). Following these ideas, we hypothesize the following relationships:

H2. Student's satisfaction with the degree positively influences the recommendations that he/she makes.

H3. Student's satisfaction with the degree positively influences the confirmation of his/her choice.

Figure 1 shows the conceptual model proposed.

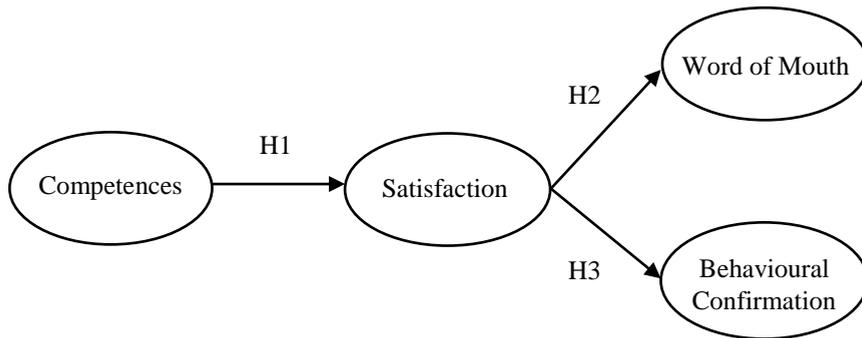


Figure 1. Conceptual model. Source: Own elaboration.

3. Methodology and analysis of model

We design an online survey to collect data, using Google Drive platform. The targeted respondents are students of any academic degree and course attached to the Faculty of Economics and Business Administration of a Spanish University (University of Zaragoza). 165 students responded to the questionnaire but 4 were eliminated because of missing data, so 161 effective questionnaires were used for the analysis (61.39% female).

Table 1 shows the items used for each variable of the model. We use the list of 26 general competences (divided into instrumental, interpersonal and systemic competences) established by the University of Zaragoza in order to measure the competences factor. Table 1 also presents the items loadings, composite reliability (CR) and construct's average variance extracted (AVE). The scales meet the requirements of these analyses in order to ensure reliability and convergent validity (Hair *et al.*, 2010). Finally, we ensure discriminant validity checking that the square root of AVE values are larger than their correlation values (Fornell and Larcker, 1981).

Table 1. Items, reliability and convergent validity.

Variable / Item	Loadings	CR	AVE
COMPETENCES		0.90	0.75
COM1: Instrumental (8 items)	0.888		
COM2: Interpersonal (9 items)	0.871		
COM3: Systemic (9 items)	0.835		
SATISFACTION		0.95	0.87
SAT1: In general, I am satisfied with my degree	0.932		
SAT2: My degree is meeting my expectations	0.933		
SAT3: Studying my degree is satisfactory	0.925		
WORD OF MOUTH		0.95	0.85
WOM1: I will speak positively of my degree to my friends and acquaintances	0.917		
WOM2: I will encourage other people to study my degree	0.925		
WOM3: I will recommend to study my degree to anyone who asks me	0.931		
BEHAVIOURAL CONFIRMATION		0.95	0.87
BC1: If nowadays I had to decide which degree to study, I would choose the same	0.966		
BC2: Without a doubt, I would choose to study the degree that I am currently studying	0.957		
BC3: If I could go back to the past, I would not choose the degree I am currently studying*	0.865		

**Reverse coded. Source: Own elaboration.*

4. Results

Structural equation modelling was applied, specifically partial least square (PLS) with SmartPLS 2.0 M3 software. This technique is increasingly used as it does not assume any type of data distribution and it provides good estimates even when the sample size is relatively small (e.g., Orús *et al.*, 2016).

Figure 2 shows the structural model results (path coefficients, its significance and R^2 for dependent variables). The development of competences throughout the degree has a positive effect on the student's satisfaction with their degree ($\beta = 0.445$; $t = 7.380$). Therefore, H1 is supported. Moreover, student's satisfaction positively affects both word of mouth ($\beta = 0.831$; $t = 26.715$) and behavioural confirmation ($\beta = 0.753$; $t = 20.373$), so H2 and H3 are confirmed. Our model explains nearly 20% of the variance (R^2) of satisfaction, 69.1% of the variance of word of mouth, and 56.7% of the variance of behavioural confirmation.

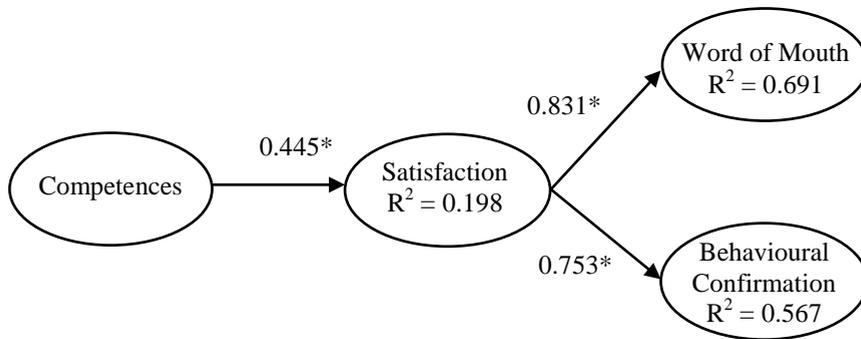


Figure 2. Structural model results. * $p < 0.001$. Source: Own elaboration.

Finally, we calculate the indirect effects of competences on the two final dependent variables of the model. The total effect of competences on word of mouth and behavioural confirmation are $\beta = 0.370$ and $\beta = 0.335$, respectively. We use both Sobel (1982) test and Preacher and Hayes (2008) macro for SPSS in order to confirm the mediation effect of satisfaction on the relationship between competences and both word of mouth and behavioural confirmation. Results demonstrate this mediation effect, providing support for indirect effects. Specifically, we find an indirect-only mediation for competences-word of mouth relationship and a competitive mediation for competences-behavioural confirmation relationship (Zhao *et al.*, 2010).

5. Conclusions and implications

The main objective of this study is to test whether the development of general competences in higher education degrees affects student's satisfaction. Previous studies analysed the importance of competences, for example, to increase the individual's adaptation to the labor market (Azevedo *et al.*, 2012), or to improve the student's satisfaction with specific subjects (De Juan-Vigaray and Gonzalez-Gascón, 2013; Orús *et al.*, 2016). Our study contributes to this literature analysing this relationship in the context of complete degrees. Results confirm that competences that are developed during the study of a business degree contribute to increase the level of student's satisfaction with that degree. We also aimed to demonstrate the relationship between satisfaction and other outcomes. Previous studies have pointed the importance of recommendations (word of mouth) and the intention to repeat past behaviours as proxies to understand the student's loyalty (e.g., Brown and Mazzarol, 2009). Our findings verify the influence of student's satisfaction on word of mouth and behavioural confirmation.

University institutions are immersed in continuous changes and adaptations to their environment, the European Superior Education Space being one of the most important in the last years. This adaptation has involved the inclusion of competences in degrees, whose development has become a priority for institutions. The development of competences in the university enables students to acquire important skills and abilities, which improves not only the student's academic performance, but also his/her opportunity to get a better job in the future (Kong and Yang, 2014). In this way, if students perceive that they have acquired general competences, they will be satisfied with the degree, will increase his/her recommendations to colleagues and friends, and will feel that his/her election was correct, leading to a greater loyalty (Brown and Mazzarol, 2009; Gairín *et al.*, 2014). All these facts will decrease the dropout rate and improve the recruitment of new students, even more in the age of social media when information is disseminated quickly (James and Casidy, 2016). Therefore, institutions have to use all necessary means to develop general competences related to the whole degree and not only to a specific subject.

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JALEA: an authentic and personal path to JApneseLEArning

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Abstract

This paper aims to present JALEA, an innovative web tool for the acquisition of the Japanese language dedicated to higher education learners. In particular it highlights the innovative learner-centered approach based on the self-guided discovery of grammar structures and words' meanings through the combined use of realia (multimedia contents referring to real-life situations in Japan), hyperlinks and interactive features such as pop-up dictionary, character-writing explanations, slow-motion option in video examples, etc. Moreover, it illustrates the ICT (Information and Communication Technology) characteristics of this web tool, permitting on the one hand the smooth working of the application on several platforms (pc, tablet and smartphone); on the other, its sustainability and maintainability thanks to the implementation of a layer accessible to maintainers (backend) with several automatization features that facilitate the addition of more contents, also by personnel with low ICT knowledge or skills.

Keywords: Japanese Language; e-Learning; Foreign Language Education; Instructional Design; Authentic Learning in Interactive Media; Digital Humanities.

1. Introduction

JALEA is a web tool¹ for the acquisition of the Japanese language that addresses the following limits related to conventional didactic tools, such as grammar reference books or course textbooks for the Japanese language. However, listed below, such limits could apply in other situations concerning non-European languages, especially those with different and challenging writing systems and those referring to unfamiliar social-cultural practices and discourses.

- Difficulty, understood as the longer time and higher economic investment to master the spoken and written Japanese language among Euro-American learners (U.S. Department of the Army, 1996; Mariotti 2016: 8).
- Constrictive, tedious and time consuming methods due to top-down and predetermined teaching texts for academic learners or, on the contrary, improvised, inaccurate and ineffective language tools for the general non academic public.
- Fragmentation of separate reference tools (words dictionary, Sino-Japanese characters dictionary, grammar reference...).
- Artificial, tailored-up materials (images, audios, dialogues) which are still linked to the conception of “preparing” to speak a different language rather than a direct engagement with a foreign language as in real life. All the aforementioned materials have the shortcomings of creating an artificial environment and following abstract standards of language execution.

JALEA is the natural evolution of an earlier project BunpoHyDict (Mariotti 2008, 2011), which basically addressed the problems mentioned above but is tackling 3 critical issues:

1. How can data related to learner navigation be gathered so as to improve the learner experience?
2. How can it be usable through different devices (pc, tablets and smartphone as well)
3. As an exponentially growing project moving towards constant update with ‘authentic materials’, how can it be maintained and sustained?

JALEA tries to solve these issues featuring new technical add-ons such as an embedded pop-up dictionary, character writing explanations and, more importantly, adopting completely new architecture that will be explained in section 3.

As a web tool, JALEA has been conceived to be used by both a self-learner without any assistance or guidance, and as a support or ‘reference-book’ by the foreign language

¹ JALEA web address as of April 24, 2017: jalea.unive.it/jalea

teachers in her/his class; however, ultimately these two modalities are meant to be combined together: on one hand, JALEA wants to exploit the role of pleasure in the autonomous discovery of new languages and ways of communicating, respecting the learner's autonomy, whilst on the other leaves more room for the foreign language teacher to explore a new and fundamental role as global citizens educator through dialogue, as critical pedagogy would suggest (Hosokawa, Otsuji, Mariotti 2016; Freire 1970).

Presently JALEA is written in Italian, as it addresses mainly the B.A. students of the Ca'Foscari University of Venice, but its approach and structure could just as well meet the needs of students of Japanese from any language background.

Japanese language learning web resources are scarce in Italian and university students rely mainly on English sites and apps, dictionaries or vocabulary-memorizing tools. Those few Italian sites consist mainly in practical suggestions for self-learning with links to external resources. There are a number of grammar lessons/articles in Italian, written in informal style, often inside blogs which features miscellaneous information about Japan. They almost reproduce grammar reference book patterns, missing the hyperlinks and authentic materials repositories, as well as the embedded words and Sino Japanese character dictionary.

2. JALEA's structure and learning paths: the frontend

The main elements of JALEA are clearly visible in the homepage: the menu at the top, and three different-coloured buttons on the bottom: *Indice grammaticale* ('grammatical index'), *Immagini e foto* ('images and photos') and *Video* ('video clips'). The top menu links to the following 5 sections:

1) Basics

This section provides the absolute beginner of Japanese with the first, essential information and knowledge about the Japanese language. It is organized in 8 tabs. In the first, the main Japanese grammar characteristics are summarized in 7 points. The other 5 tabs are then devoted to the unfamiliar writing system of Japanese, introducing the coexistence of 3 different components: Sino-Japanese characters, *katakana* and *hiragana* syllabaries. The latter two are listed in tables in which, with a mouse-over, a pop-up explains how they are written. The two last tabs, biblio/webliography and useful external links, offer more detailed information if required.

2) *La storia* ('history') & 3) *Il gruppo* ('research group')

The History section recalls the past projects (BunpoHyDict 2008, ITADICT 2010, EDUKANJI 2012) and experiences that lead to JALEA, and also provides further tools for Japanese learners. For example, the past project EDUKANJI (Mantelli 2012) is offered here as a specific learning tool for the comprehension and memorization of Sino-Japanese characters, thanks to its exercises. Finally the (manga style) research group presentation also wants to underline the light and playful albeit scientifically rooted approach of this web tool.

3) *Morfemi* ('Morphemes' or 'grammatical items')

By clicking on this link the learner visualizes the morphemes index with an additional menu for alphabetical search. This is one of the main components of JALEA, in which knowledge of the Japanese grammar is provided through the explanation of all grammatical items a student enrolled in a Ca' Foscari University of Venice bachelor's course is supposed to master by the end of her/his path. This index is also accessible by clicking the violet button.

4) *Video* ('video clips') and 5) *Immagini* ('images')

By clicking on these links the learner gains access to the other main components of JALEA, namely the repository images and clips referring to *realia*, i.e. authentic materials from real life situations in Japan, without any process of tailoring their contents to the level of the learner. Apart from providing a glimpse of what real Japanese language in real Japanese context is, these authentic materials were also chosen in view of the interest and pleasure of discovery that they should hopefully arouse in the learner's mind (Mariotti 2015). The clips and images indexes are also accessible by clicking respectively the green and yellow buttons in the home page. Given this main structure of JALEA, the learning path can be of a twofold nature. One starting from the need to know a specific grammar item; the other triggered by curiosity towards authentic materials and leading to a self-guided discovery and comprehension.

2.1. Looking for a specific grammar item

Let us assume, for example, that an Italian beginner studying Japanese wants to read an online Japanese newspaper. Although useful web tools already exist, like online dictionaries or pop-up dictionaries in English such as Rikaichan (an extension to be added to the browser which also de-inflects verbs), a learner of Japanese, especially a non-English-speaking one, may want to understand the exact use of a specific grammar item in particular like, let's say, the particle に *ni* in its value (among others) as a temporal postposition like in the phrase 五時半に *go ji han ni* ('at half past five'). Selecting the grammar item s/he is searching for from the alphabetical list, the main page of that item

(particle, idioms, suffix..) will appear, in this case the grammar item じ *ni*. The first impact will be with a photograph of authentic Japanese Language in use: a ‘manner poster’ inside a Odakyu bus in Mitaka-Tokyo. A green arrow indicates the grammar item inside the photograph, providing a visual example of its use. If clicked, the green arrow leads to a subsection explaining the use of the grammar item in that particular context. In addition to the photo, the components of the main page of a grammar item are:

- Basic information, namely the grammatical definition, an approximate translation and the general meaning/value underlying all the various uses.
- Links to additional information pages, namely the list of its various uses (as complements, in creating subordinates...), its construction (in case of inflective grammar items) plus further in-deep analysis.
- Links to related morphemes.
- Links to images and video clips featuring that morpheme.

By clicking on the additional information links, especially the ones concerning the specific uses, the learner will find practical schemes in which sample sentences are analysed with glosses and grammatical categorization of each component. Further examples of sentence patterns are given, voiced by audio clips by a non-professional speaker or by a voice synthesizer. Let us go back to the learner who needs to understand the postposition *ni* in the above presented phrase *go ji han ni*. S/he could either be satisfied with the information given on the main page or may need to investigate further. By using a dictionary s/he could discover the meaning of the other words: *go* ‘five’, *ji* ‘hour’, *han* ‘half’, and suppose that has something to do with an expression of time. Therefore, observing among the additional information links provided on the main page that *ni* also functions as a complement of time in Italian (*complemento di tempo determinato*) s/he will click this link and verify that s/he was right, thus hopefully feeling the pleasure of self-guided discovery that will reinforce this information in her/his brain (Caon 2006).

2.2. Self-guided discovery

The above cited self-guided discovery / self-guided comprehension is the core of the second learning path of JALEA, which ultimately makes it different from a simple digital transposition of a grammar reference. This learning path starts from the repositories of multimedia *realia* examples, which are selected from all kinds of media: representative novels read aloud (audio clips), newspaper articles, manga, anime, documentaries, movies trailers, printed and filmed commercials, road signs, music video clips, answering machines, automatic teller machines etc... For example, by clicking on the video clip’s repository button and selecting one of them, the learner will be presented with:

- The video clip, with full commands under the screen to stop, replay and slow it; and the link to the source of the example;
- A timed transcription of the text in Japanese, together with transliteration in Latin characters, all the sentences of which are highlighted when pronounced in the video clip. Moreover, by clicking on each sentence the video will replay from that point, allowing repetition and facilitating listening comprehension;
- A list of the links to the main pages of the grammar items related to the text;
- A link to the full translation of the text.

However, the main characteristic of JALEA consists in each grammar item of the text being linked to the specific additional information pages, enabling the learner to decode each particular use of grammar items inside a specific text. This function, along with an embedded pop-up Japanese-Italian dictionary that automatically appears when the mouse is over a word, provides the learner with virtually all s/he needs for the comprehension of the text. It goes without saying that JALEA can be used in the lecture theatre too. As explained above, each grammar item is explained from its basic meaning to its particular uses and exceptions, with plenty of tables, schemes and sample sentences. Alternatively, in the classroom a teacher may want to explain the use of a particular grammar item, starting with its use in real contexts (i.e. not starting with a general explanation). Each grammar item is listed with two links that lead to all the video clips and images featuring that particular item in its diverse uses. It should be noted, moreover, that the grammar items list also includes those grammar items that do not usually stand alone, but are considered variations of primary grammar items. For example the *-cha ikenai* expression “cannot be done” is a colloquial variation of the *-te wa ikenai* expression, which in turn is one of the various uses of the verbal *-te* conjunctive form. The *-cha ikenai* expression is collocated under the more general *-te* form, but if needed, it can be directly found by a simple alphabetical search in the morphemes’ index. By clicking on *-cha ikenai*, it will then lead directly to the correspondent additional information section of the *-te* form page.

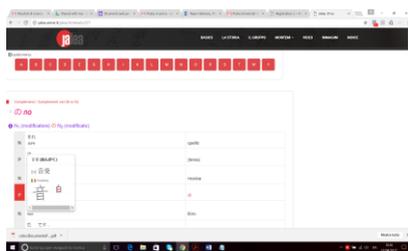


Figure 1. Grammar & Pop-up Dictionary

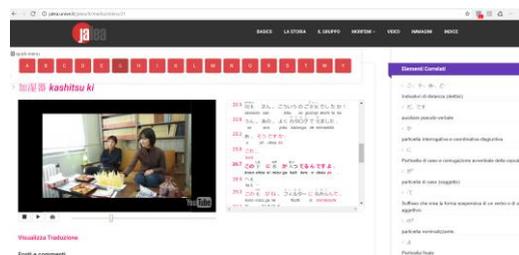


Figure 2. Text Syncing Functionalities

2. JALEA's ICT (Information and Communication Technology) Architecture

JALEA has been developed using a client - server model architecture with a LAMP (Linux, Apache, MySql/MariaDb, PHP/Python) stack software model. PHP has been used as server-side language and MySql as database. The Programming code has been organized in a Model-View-Controller Pattern with the usage of a framework called CodeIgniter, thus allowing the separation of the organization logic and presentation logic. The client component (the content visualized in the browser) has been developed using the Bootstrap library in a responsive format. This basically means that all the page content is resized and reorganized according to the window/device size, thus allowing a smooth application usage even in smartphones and tablets. Moreover, all the pages are AJAX-oriented, a technology that allows data to be sent and retrieved from the server and for the contents to be updated without reloading the page. Thanks to this approach, pages are loaded and displayed faster. At a macrostructural level the application can be divided in 2 main sections: a) public b) private.

a) Public area or FrontEnd

This is the section that all users can access. Some part of the public area will be restricted and access will be granted by the login-password authentication method.

b) Private Area or BackEnd

This is the Control Panel accessible to the administrators through login and password. In the Control Panel administrators can edit, insert or delete all the contents such as tags, morpheme wrapping and examples. Administrators can also upload photos, audio, links to YouTube videos or create voice using text-to-voice libraries. Managing video-, and audio-voice contents requires a considerable effort. Where possible several activities have been automatized. For example: there is no need to insert the *kana* (syllabaries) and *romaji* (Latin characters) transliteration of the sentence samples manually as they are automatically converted by the Mecab morphological analyser. If a native-speaker audio file is not uploaded for a certain sentence, this can be automatically converted to speech with a text-to-speech automatic engine. Moreover, a voice file can be created ad hoc through the control panel apposite function by selecting one of the two text-to-speech engines available and by changing parameters such as character voice, pitch and speed. Finally, by using the YouTube API, the scripts prepared by the administrator can be synced with the uploaded video. This allows the user to navigate the video and listen to the same sentence over and over if needed. The Client Server Approach and the implementation of a Database Oriented logic makes it possible to gather data from learner navigation, and in so doing, to face the first critical issue that emerged in previous research projects (see p.1). The Bootstrap Library used in the client area development responds to the second issue as it makes Jalea usable through different devices. The last third issue regarding project

maintainability has been tackled by dividing the macrostructure into two sections: frontend and backend, so that contents can be easily updated by any approved user. Database structure is ready for multi-language implementation since multi-language fields are already divided in different tables.

4. Conclusion

At the time we are writing this paper, JALEA structure and contents are currently in the development phase but we will be able to gather feedback from students from March 2017 on. The features explained so far are targeted to the learner's listening/reading comprehension (passive competences) and grammar acquisition needs, so our next step (2018) will be to add a section aiming at "language production" skills. Thanks to the flexible database structure of JALEA, we plan to provide an index search of the various grammar items starting with their meanings and communicative functions (i.e. 'how do I say "I want to..." in Japanese'). Moreover, the selection of the first communicative functions will be based upon the results of the workshop Action Research Zero (Mariotti, Ichishima, Hosokawa 2017) based on pioneering FLT theories (Hosokawa, Take 2012) in which absolute beginners only faced grammar in the authentic context of a community dialogue. In lieu of conclusion, we would like to state why, with this paper, we want to disseminate information about a project which is still in the making: as an applied research project in language education it is in constant evolution and in constant need of new perspectives and new problems that we hope we will receive from our readers.

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Education as absorptive capacity and its role for economic growth

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Abstract

Might a country's economic growth behave in a different manner depending on the evolution of its absorptive capacity? In this research, education is considered as a channel for economic growth since it is a key element for a country's absorptive capacity. Then, we hypothesize the existence of a threshold for absorptive capacity, so that once it is exceeded, economic growth shows certain (and different) characteristics. Addressing this question requires moving from the traditional linear framework to a nonlinear one and, in this sense, we resort to Smooth Transition specifications. The empirical results point to the existence of nonlinearities in the relationship between absorptive capacity and economic growth. According to the behavior of the country's absorptive capacity, economic growth displays different dynamics; this asymmetric evolution is clearly appreciated in the two dimensions of absorptive capacity taken into account (i.e., secondary and tertiary), although it is more pronounced in case of tertiary education. Our evidence provides important insights for higher education such as the fact that both secondary and tertiary education matter for countries' economic growth and that nonlinearities of this relationship should be taken on board.

Keywords: *education; absorptive capacity; economic growth; network society; nonlinearities; Smooth Transition models.*

1. Introduction

The objective of the present paper is to analyze the relationship between education and economic activity from a new perspective. Specifically, we understand that a country with a population able to exploit new knowledge will perform better. Therefore, education is considered a channel for economic growth since it constitutes an intrinsic mechanism of knowledge absorption¹ and then, it is a key element for a country's absorptive capacity. Following Cohen and Levinthal (1990), Zahra and George (2002), and Márquez-Ramos and Martínez-Zarzoso (2010), we consider absorptive capacity as the ability to put information from abroad into practice, which plays a key role in economic development. In this vein, we focus on exploitation capabilities and examine their role in economic growth. As a consequence, our interest goes beyond the consideration of years of schooling as a potential determinant of economic growth: we generalize to countries' exploitation capabilities and explore the inherent nonlinearities in the absorptive capacity-economic growth relationship.

This research has a bearing in the literature of education and economic growth, which has analyzed the causal effect of education on countries' economic performance using a variety of measures and quantitative tools for cross-country, time series and panel data. In this brand of the literature, Hanushek and Wößmann (2010) highlighted that economic growth is affected by people's knowledge. Also the importance of nonlinearities has previously been identified, as the work of Krueger and Lindahl (2001) points out.

The present paper brings into question the linearity assumption by using time series techniques for 1971-2013 in Spain, as we believe that the role of absorptive capacity can be that of a force driving a possible nonlinear behavior in the economic growth. Moreover, we incorporate additional variables that are closely related to both absorptive capacity and economic growth, as they also affect this relationship. Focusing on the case of Spain is of great interest, mainly because Spain is a country with a solid trajectory in its education system and it is also a developed economy that is representative of a large number of countries. In this case study, we are able to provide evidence of the nonlinear relationship between absorptive capacity and economic growth at country-level. This analysis will also help us to shed light on the question posed by the existing literature about the positive, although still without consensus, impact of education on growth.

The paper is organized as follows. Section 2 presents the methodology employed. Section 3 explains the empirical results obtained. Section 4 concludes.

¹ See, for example, the illustration of the role of education in the aerospace sector for establishing sufficient levels of absorptive capacity in Asia (van der Heiden et al., 2015).

2. Methodology

One common assumption when analyzing the relationship between two variables is that of linearity. Actually, the majority of empirical papers centered on the education-economic growth link are grounded on the linear consideration. Nevertheless, this assumption is too strong if what we aim to analyze is the relationship between absorptive capacity and economic growth, as this would mean that the parameters in the relationship do not change over time. This is, however, unrealistic as it would reflect that learning and innovation processes are linear (Márquez-Ramos and Mourelle, 2016). By using Smooth Transition Regression (STR) models, we allow for the parameters to change depending on a shock, which is defined on an ad hoc basis. This framework provides us with more flexibility when studying the dynamics of economic growth and other variables related to absorptive capacity. The reason for selecting this type of models is in line with the idea of a potential threshold that determines the behavior of the economic growth according to some variable.

Smooth Transition (ST) models belong to the family of state-dependent models where the data-generating process is linear but switches between a certain number of regimes according to some rule. STs have been popular in economic time series, proving good performance in capturing cyclical behavior in macroeconomic variables. For further details on these models, see Teräsvirta (1994, 1998) and van Dijk et al. (2002).

We resort to the most general ST model, the STR, as it permits the incorporation of exogenous variables in addition to the endogenous structure. Let y_t be a stationary, ergodic process and, without loss of generality, one exogenous variable x_t . The model is given by:

$$y_t = w_t' \pi + (w_t' \theta) F(s_t; \gamma, c) + u_t, \quad (1)$$

with $w_t = (1, y_{t-1}, \dots, y_{t-p_1}; x_t, x_{t-1}, \dots, x_{t-p_2})'$ a vector of regressors; $\pi = (\pi_0, \pi_1, \dots, \pi_p)'$ and $\theta = (\theta_0, \theta_1, \dots, \theta_p)'$ parameter vectors ($p=p_1+p_2+1$); and u_t an error process. $F(\cdot)$ is a transition function customarily bounded between 0 and 1, so that STR coefficients vary between π_j and $\pi_j + \theta_j$ ($j = 0, \dots, p$), respectively. The regime at each t is determined by the transition variable, s_t , and the associated value $F(s_t)$; the transition variable can be a lagged endogenous variable, an exogenous variable or another variable. The slope parameter γ defines the smoothness of the transition: the higher it is, the more rapid the change; the location parameter c indicates the threshold between the two regimes.

Two formulations are mainly used for F : logistic and exponential. In the logistic model the extreme regimes are associated with s_t values far above or below c , where dynamics may be different; otherwise, in the exponential case the extreme regimes are related to low and high absolute values of s_t , with rather similar dynamics, which can be different in the transition

period. Conceptually speaking, the logistic transition appears to be the most suitable for describing our relationship, as there is no reason to assume a similar effect for a positive and a negative variation in the absorptive capacity of a country on its economic activity.

The STR model is estimated by nonlinear least squares. Following the related literature, we carry out an extensive search of STRs by defining a grid for (γ, c) , trying for different values of γ and using the mean of the transition variable for c . Where parameter convergence is reached, models are subject to further refinement; we evaluate cross-parameter restrictions to increase efficiency and drop nonsignificant coefficients to conserve degrees of freedom.

In the ST framework, special attention is given to the validation stage, as it unveils any possible inadequacy of the model. Most tests commonly applied to dynamic models are also valid for STs. Besides, there are evaluation tests especially derived for STs: the test of residual serial independence; the test of no remaining nonlinearity in the residuals; and the test of parameter constancy. In this paper, we use the adjusted R^2 and the variance ratio of the residuals from the nonlinear model and the linear regression estimated by Ordinary Least Squares (OLS), as it provides relevant information on the explanatory power of both models. In addition, we use the test of no ARCH structure and the specific STs tests.

Finally, in order to offer a better characterization of the relationship under study, we also develop a structural analysis of the STR model through the definition and understanding of the theoretical paths economic growth would follow in response to changes in education.

3. Empirical results

3.1. Data and preliminary analysis

As mentioned above, the data used for this empirical application is centered on the Spanish case. Real and seasonally adjusted Gross Domestic Product (GDP) is obtained from the International Monetary Fund's IFS database; GDP is traditionally considered for measuring economic activity. We measure absorptive capacity by using gross enrollment ratios for secondary and tertiary education (available from the World Bank); we denominate dimension 1 to our measure for secondary education and dimension 2 to tertiary education. The proxies for labor force are defined by calculating the proportion of active population with secondary (tertiary) education over total active population (data obtained from The Valencian Institute of Economic Research, IVIE); in the context of our research, these variables proxy for the prior knowledge base in Spain. For the physical capital, we use real Gross Fixed Capital Formation (IVIE database); we include investment as it exerts an indirect effect on education. Finally, the government expenditure on education (% of GDP, World Bank) serves as a control variable that allows to isolate the relationship between absorptive capacity and economic growth. The sample goes from 1971 to 2013 and we use annual data. All variables are used in logarithms. Figure 1 depicts the variables over time.

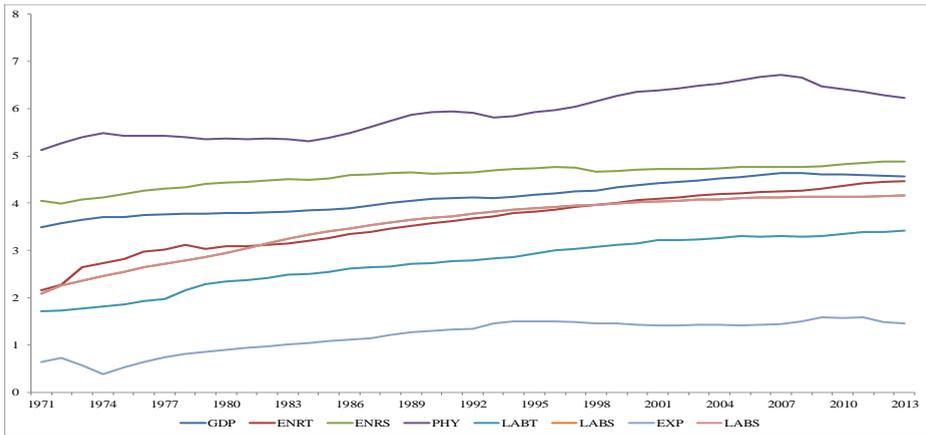


Figure 1. Evolution of the variables over time, in logs. Source: Own elaboration. Notes. ENRT: enrollment ratio tertiary education (ENRS for secondary education); PHY: physical capital; LABT: labor force tertiary education (LABS for secondary education); EXP: government expenditure on education.

Before focusing on the relationship between economic growth and absorptive capacity, a statistical processing of the information is required. In particular, all the variables involved in the study must be stationary, a property that is evaluated by means of unit root tests. In this sense we have applied the Ng and Perron (2001) unit root tests. Results are not shown for space reasons². All the variables considered in the study are unit root processes. These results point out the need for applying regular differences in all our variables.

3.2. Estimated models: Discussion

Three aspects must be remarked. First, as specific data regarding enrollment and active population ratios for secondary and tertiary education is available, the estimation process has two branches so as to distinguish the two dimensions of absorptive capacity. Second, four explanatory variables are initially included in the analysis: education, physical capital, labor force and expenditure on education. Third, we consider up to two lags of the variables in the regressions to account for the effect of their most recent history on economic growth.

The starting point of the modelling procedure consists of finding out the linear model that would describe the behavior of our series. OLS estimation is carried out; all parameters are introduced initially, but then those nonsignificant at a 0.05 level are successively excluded (results not reported). The next stage is the estimation of the nonlinear models. We achieve valid STR specifications for the secondary and tertiary education. As our main purpose is to study the impact of absorptive capacity on economic growth, the decision on the transition variable is clear: the enrollment ratio. Then, this variable plays a double role in explaining the economic growth dynamics. On the one hand, it represents the source of nonlinearities

² Along the paper, all the results not shown for space reasons are available from the authors upon request.

in the evolution of economic growth; on the other hand, it is also a determining factor of GDP growth dynamics. Table 1 presents the estimated models, along with several diagnostic statistics and evaluation tests.

Table 1. Estimated STR models

	Secondary education		Tertiary education	
	Transition variable: $\Delta IENRS_{t-1}$		Transition variable: $\Delta IENRT_{t-2}$	
	Linear part	Nonlinear part	Linear part	Nonlinear part
ΔGDP_{t-1}	-1.308 (0.259)	3.969 (1.381)	0.655 (0.148)	-1.346 (0.281)
ΔGDP_{t-2}	1.426 (0.248)	-2.661 (0.804)	0.320 (0.144)	
$\Delta IENRT_t$			0.176 (0.057)	-0.341 (0.120)
$\Delta IENRT_{t-1}$			-0.505 (0.120)	0.670 (0.137)
$\Delta IENRT_{t-2}$				
$\Delta IPHY_t$		0.564 (0.143)	0.233 (0.028)	
$\Delta IPHY_{t-1}$	0.558 (0.066)	-1.509 (0.478)		0.176 (0.071)
$\Delta IPHY_{t-2}$	-0.476 (0.131)	0.835 (0.266)	-0.182 (0.070)	0.225 (0.070)
$\Delta ILABS/T_t$	-0.847 (0.318)	1.264 (0.529)	0.068 (0.035)	0.068 (0.035)
$\Delta ILABS/T_{t-1}$	1.075 (0.359)	-1.765 (0.624)	0.170 (0.047)	
$\Delta ILABS_{t-2}$	0.164 (0.093)			
$\Delta IEXP_t$				0.080 (0.045)
$\Delta IEXP_{t-1}$			0.212 (0.077)	-0.152 (0.084)
$\Delta IEXP_{t-2}$		-0.083 (0.041)		
γ	2.172 (1.005)		66.647 (375.649)	
c	0.015 (0.009)		0.052 (0.003)	
\bar{R}^2	0.92		0.87	
s^2/s^2_L	0.25		0.33	
ARCH	0.266 (0.768)		0.097 (0.907)	
AUTO	2.886 (0.083)		3.525 (0.056)	
NL	2.597 (0.235)		2.499 (0.324)	
PC	1.398 (0.380)		1.088 (0.549)	

Source: Own elaboration. Notes: Δ denotes first differences and l stands for the logarithm. Values after regression coefficients are SEs of the estimates; \bar{R}^2 : adjusted determination coefficient; s^2/s^2_L : variance ratio of the residuals from the STR model and the linear regression; ARCH: statistic of no ARCH based on 2 lags; AUTO: test for residual autocorrelation of order 2; NL: test for no remaining nonlinearity; PC: general parameter constancy test. Numbers in parentheses after evaluation statistics are p-values.

Going into detail on dimension 1 of exploitation capabilities, we appreciate notably significant coefficients in the estimated model that highlight the dependence of economic growth on its recent history, as well as on physical capital, labor force and expenditure on education. As it is observed, the first dimension of absorptive capacity is not a determining factor for economic activity. Figure 2 depicts the estimated transition functions.

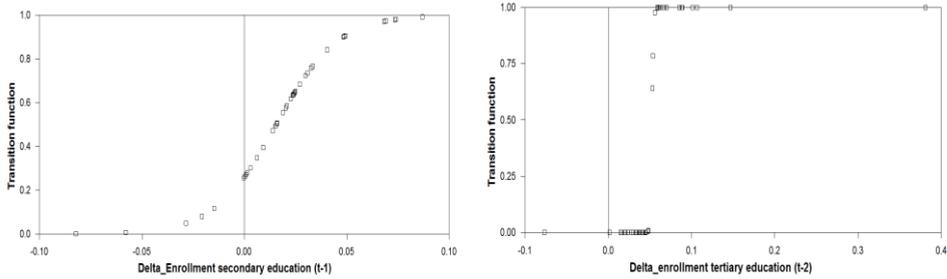


Figure 2. Estimated transition functions. Source: Own elaboration.

The transition between regimes is smooth, according to γ , and the delay is one year. We can define a lower extreme regime, covering from negative growth to 1.5% variation in the enrollment ratio, and an upper extreme regime, for rates greater than 1.5%. The estimated threshold is slightly below the enrollment ratio mean (2%). The model presents no evidence of misspecification; there are no signs of ARCH structure and the validation tests do not detect serial dependence in the estimated residuals, there is no need for a second transition function and parameter constancy is demonstrated. A fact to emphasize is the high explanatory power of this model compared to the linear one: according to the variance ratio, the STR model explains 75% of the residual variance of the linear regression.

Turning now to the second dimension of exploitation capabilities, the estimated parameters are again highly significant, indicating that recent history of economic growth has effects on its current state, as well as enrollment ratio, physical capital, labor force and expenditure on education. In contrast to the previous dimension, the enrollment ratio in tertiary level is a significant determinant for the economic growth dynamics in Spain. This result indicates that higher education is a key factor for economic development and, in terms of absorptive capacity, we interpret that it is very important for economic growth that people in a country are “creators” and not only “users” of those tools required for processing innovation and creation. We consider that a higher number of “creators” in a country increases the country’s potential to put new information and knowledge into practice by developing new products and processes that conduct to economic growth.

Another difference with secondary education are the features of the transition from one regime to the other: now it is quite abrupt and the delay is two years instead of one. In fact, these extremely rapid regime changes suggest the need for threshold specifications, strengthening the importance of using STR models. Therefore, economic growth evolves more rapidly from one extreme regime to the other when considering the second dimension of absorptive capacity; that is, economic growth reacts in a more immediate way to shocks in tertiary education. A possible cause can be found in the high weight traditionally given to pursuing an university degree in Spain; a historical and sociological background points to a more rooted character of higher education in Spain than in other similar countries.

Two regimes arise from this model: a lower extreme regime, ranging from negative growth to 5.2% variation in the enrollment ratio, and an upper extreme regime, for variations greater than 5.2%. The threshold is remarkably close to the mean of the transition variable (5.7%). There are no indications of misspecification, so one may conclude that this STR model is adequate. Once again, this model shows greater explanatory power than the linear formulation: the STR model explains 67% of the residual variance of the linear regression.

3.3. Short-run dynamics analysis

This study consists of analyzing the path that economic growth - whose behavior is described by a nonlinear model - would keep after the effect of changes in absorptive capacity. As a result, the immediate effect of these changes (in sign and quantity) and how the variable returns to an equilibrium path can be appreciated. Two considerations must be taken into account beforehand. First, the starting value for the variation of the proxies used for measuring absorptive capacity (i.e., enrollment ratios) corresponds to its sample mean. Second, the values of the other regressors remain constant at a certain level (its sample mean) when examining the effect of a change in the enrollment ratio on economic growth.

We simulate the evolution of economic growth according to its behavior defined by the STR model. Regarding the first dimension of absorptive capacity, the point of departure is a stationary equilibrium state characterized by a 1% enrollment ratio rate of growth (the mean rate for this variable is below 2% in our sample). In the first exercise, the enrollment ratio passes from growing at a 1% to a 1.5%. This evolution causes an increase in economic growth in the short run; the impact is quite outstanding at the beginning and moderate (even negative) afterwards. The return to an equilibrium growth is achieved several years later.

A further distinctive feature of nonlinear models is the lack of symmetry in the responses of the variables aftershocks (the linear context implies symmetry). Along these lines, we carry out a second exercise, where the enrollment ratio steadily rises at a 1% until it starts to rise at a 0.5%. This slower pace involves a severe fall in economic growth; the impact is quite irregular but always means negative values, and the path towards the stationary location takes longer than in the previous exercise. We clearly observe the absence of symmetry when considering two comparable situations (plus or minus five percentage points).

Regarding the second dimension of absorptive capacity, the starting point is a stationary equilibrium state characterized by a 3% enrollment ratio growth rate (the mean rate for this variable is below 6% in our sample). In the new exercise, the enrollment ratio starts to grow at a higher rate (5%) than the initial one (3%). Following the theoretical path, the economic growth reacts with a moderate increase in its growth level; after several years, the variable begins to fall to the long-run location. In the last exercise, the enrollment ratio experiences a decrease in its growth rate (from a 3% to a 1%). The evolution of the economic growth

turns unfavorable after this shock; economic activity grows at almost zero rates during the first years but then faces with negative rates. We appreciate again the lack of symmetry.

In short, the simulation study appears to point to a direct impact of absorptive capacity in the short run (with the two dimensions) on economic growth. As a remarkable fact, the effects become more severe when the enrollment ratio (and hence absorptive capacity) decreases its growth rate; in this case, a decrease in absorptive capacity impacts economic growth generating a larger negative effect when there is a decrease in the number of “users” (i.e. secondary education) than in the number of “creators” (i.e. tertiary education) of those tools required in the society. An explanation may rest on the fact that secondary education, apart from an objective itself, is also the previous requirement for higher education studies; in other words, a certain proportion of “users” will be “creators” in the future.

An important conclusion we can draw from the analysis is that in order to economically succeed, it seems necessary that countries maintain and foster their level of absorptive capacity, not only by maintaining (or increasing) their achieved number of “users” of those tools required, but also by increasing the number of “creators”. Therefore, under the contemporaneous societal changes that we are experiencing worldwide, going from an industrial society, to a knowledge society and, finally, to a network, the future role of universities and other higher education organizations should be a priority for the development of countries.

4. Conclusions

This paper analyzes the nonlinear relationship between absorptive capacity and economic growth at country-level. To do so, it focuses on secondary and tertiary enrollment in Spain. The empirical framework is that of time series (from 1971 to 2013) and, more specifically, we estimate Smooth Transition Regressions, which are able to explain our relationship of interest in a satisfactory manner. The asymmetric evolution of economic growth is clearly observable in the two dimensions of absorptive capacity taken on board (secondary and tertiary), although it is more pronounced in the case of higher education. In sum, this research proves the crucial relevance of education, and of higher education in particular. Our main policy implication is that governments must care for their educational system, not only for its intrinsic importance, but also for its effects on a country’s economic growth.

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New opportunities of computer assessment of knowledge based on fractal modeling

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Abstract

In this article the urgent problem of control systems modeling of professional competences and mathematical knowledge assessment of students is discussed. Pedagogical expediency in management of students' cognitive activity by using of new informational technologies instruments in monitoring and assessment of knowledge is proved. The possibility of fractal methods application in perfecting of the system of computer monitoring of mathematical knowledge of students as a part of the adaptive training systems is considered and realized. The design of the technology of computer monitoring of students' knowledge on the basis of fractal methods includes the following stages: development of cross-disciplinary fractal and organized base of key mathematical concepts; the creation of the expansible bank of educational and cognitive and research tasks, which is coordinated with fractal structure of the conceptual framework; the development of the program module, which is focused on individual estimation of quality of students' educational cognitive activity in two characteristics — depth of knowledge based on the Hurst exponent and the size of synergetic effect of educational cognitive activity. The software realization of technology of the computerized control of training in mathematical disciplines quality as a part of the adaptive training system is enabled in the programming language C#. The experience of implementation and operation of the controlling systems realized in the adaptive training systems based on the fractal model operation showed reliability of their work and allowed to increase the quality of educational process management and its effectiveness in general. Using of fractal techniques in computer assessment of mathematical knowledge of students makes it possible to increase the accuracy and speed of evaluation of the students' knowledge, to diagnose a wide range of cross-disciplinary knowledge within one discipline.

Keywords: *Qualimetry, fractal, assessment of knowledge, training of mathematics.*

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1. Introduction

Monitoring of professional competences formedness and evaluation of trainees` knowledge is one of productive methods of the modern student teaching and the necessary mechanism of monitoring of didactic system functioning and its development. The leading role in monitoring and diagnostics is assigned to the teacher. The teacher solves a complex problem of obtaining information about students as about the subject of tutoring, a condition of their experience, their personal qualities, knowledge, abilities, skills. It is necessary for the purpose of ensuring effective management of cognitive activity and development of the personality of the student. The modern level of development of the informational and communication technologies (CT) allows readdressing this function to computer systems, i.e. there is an evolutionary transition "traditional monitoring — monitoring with use of technical means — computer monitoring".

Computer monitoring and formation of professional competences evaluation is the program module in the automated training system (ATS). "ATS is a computer ergatic system intended for optimization of the tutoring process with the use of informational and communication technologies instruments, based on the automation of the processes of the trainee`s activity management" [Robert (2012)]. Close integration of tutoring process and monitoring is implemented in the modern automated training systems, which are constructed with the application of artificial intelligence methods. The method of stage-by-stage specification and activization of trainees` knowledge is the basis for the technology of such models creation. The possibility of individualization of tutoring is one of the most important advantages of use of ICT in the automated systems [Robert, 2010; Uglev, 2010]. By dint of adaptive and intellectual technologies the training system considers individual abilities of the student, his previous and current knowledge, abilities.

Questions of pedagogical monitoring and assessment of knowledge are developed by the famous scientists — A. I. Berg, V. A. Bolotov, B. Y. Likhtsinder, I. Y. Lerner, etc. Significant results were received in the field of structuring test tasks, creation of adaptive testing technologies (V. S. Avanesov, A. M. Mayorov, J. Kettel, E. Tornodayk, A. G. Shmelyov, J. Fischer, etc.) [Avanesov (2005), Shmelyov (2013)]. Today are developed and widely adopted new methods of diagnosis of students' knowledge and control of the training results at an ICT basis, in particular, automated systems for the control of experts` training quality, electronic systems of a qualimetry of professional knowledge, the automated systems of test monitoring (SAT system), rating systems of assessment of knowledge, etc. (I. I. Kibzun, V. L. Latyshev, V. V. Myakishev, I. D. Rudinsky, U. M. Neumann, I. V. Robert, etc.) [Kibzun (2006), Latyshev (2009), Myakishev (2002), Rudinskiy (2005), Robert (2012)]. These techniques allow estimating the level of assimilation of a training material not only quantitatively, but also qualitatively. The

methods of mathematical statistics, a decision theory, a fuzzy logic and artificial intelligence are a methodological basis of such systems .

The interactive system of a qualimetry of students` knowledge on the basis of fractal methods allows increasing to a significant degree the accuracy, the speed and the depth of evaluation of the students` training level, as well as the intelligent systems and integrative qualities operations, which allow developing and applying interdisciplinary knowledge and skills in their professional activity. The essence of the use of fractal techniques in the diagnosis is the symbiosis of qualitative and quantitative assessments of mastering complex structures of educational elements. This approach is especially important for a qualimetry of mathematical education where naturally arising multistage abstractions of object contents create conditions for development of the complex mathematical structures.

Another important aspect, that was not considered in the diagnosed techniques earlier, is the question of assessment of synergetic effect of the experience increase and personal development of the trainee resulting from educational cognitive activity. This effect is due to the coherent and coordinated in space and time action of the different in their nature operational mechanisms, which lead to high-quality changes in the student's personality. This synergistic effect is shown as an additional result in a context of integration of scientific knowledge in general and expansion, deepening of the internal structure of self-organization of mathematical knowledge in particular.

Integration of mathematical, humanitarian and natural science knowledge during development of the difficult educational elements is inseparably linked with a problem of the organization of monitoring. The key parameters are the speed and accuracy of the efficiency evaluation of production procedures and current processes. Improvement of these parameters is possible due to the use of ICT achievements. However, the estimated parameters are qualitative character. The quantitative data are necessary for computer processing. The developed methods allow to digitize the obtained results, including the amount of the synergetic effect. Thus, the author's proposed solution is very relevant and productive in the definition and qualification of "zones of proximal development."

2. Methods

Let's consider the possibility of application of fractal methods in perfecting of system of computer monitoring of trainees' mathematical knowledge as a part of ATS. The first stage of the control system modification is the development of structure of system of key mathematical concepts with application of fractal methods, based on basic properties of fractals — self-similarity and preservation of an invariant. Moreover, by means of fractal structuring of the training mathematical material the process of establishment of forced correlation of the information space clusters at the different levels of fractal structures interpenetration takes place. This process allows establishing the level and depth of cross-disciplinary communications between the studied descriptors.

So, we consider educational and conceptual constructs as developing self-similar structures, that reflect the self-similarity of the integral in all its divisible parts in connection with an identical circuit of construction of all structural elements of the education content. The choice of a fractal set is proved by the fact that the fractal is a suitable construct of efficient compression and packing of the acquired information in its structure. Identifying mathematical concepts with a fractal set, for example, with The Sierpinski triangle, we have an opportunity to translate idea of the degree of connection of concepts into the language of geometrical images and an opportunity to visually illustrate a coupling of all concepts. The model of a building block of knowledge (mathematical concept) has an appearance:

$$S = \Delta \cap (\Delta_1^1 + \Delta_1^2 + \Delta_1^3) \cap \left\{ (\Delta_2^1 + \Delta_2^2 + \Delta_2^3) \cup (\Delta_2^4 + \Delta_2^5 + \Delta_2^6) \cup (\Delta_2^7 + \Delta_2^8 + \Delta_2^9) \right\},$$

where Δ — the basic mathematical concept corresponding to the level of fundamental knowledge; $\Delta_1^1, \Delta_1^2, \Delta_1^3$ — the concepts formed after the first iteration (level of all-vocational training), and corresponding to interobject, humanitarian and naturally scientific fields of knowledge respectively; $\Delta_2^1, \Delta_2^2, \Delta_2^3$ — the concepts formed after the second iteration (level of practical self-realization) and corresponding to intersubject domain; $\Delta_2^4, \Delta_2^5, \Delta_2^6$ — the concepts formed after the second iteration (level of practical self-realization) and corresponding to humanitarian field; $\Delta_2^7, \Delta_2^8, \Delta_2^9$ — the concepts formed after the second iteration (level of practical self-realization) and corresponding to the scientific field of knowledge. At the same time the training material presentation is made so that there is a change, building and improvement of the available mathematical structures, transition to higher step of the organization, when the structure created earlier becomes substructure new and wider. We consider the process of formation of mathematical concepts structure, taking into account the allowed time of tutoring, to the third level with the degree of structure complexity approximately equal 1,6. It is possible to

construct structure of the tutoring content, having brought process of iteration to several orders. However, such division does structure too unwieldy, confusing the main maintenance of educational area.

We apply the coefficient of depth of assimilation of a concept and its interrelation with other concepts for the quantitative assessment of the quality of assimilation of a training material (or an index of a cross-disciplinary connectedness of concepts). This index is expressed through the fractal dimension of the D stream of informational cluster (the density of filling of clusters). Fractal dimension is automatically calculated by ATS through The Hurst exponent. Fractal dimension of D is related to The Hurst exponent a prime ratio of $D + H = 2$.

The calculation of the Hurst exponent establishing a persistence measure (tendency of process to trends) allows predicting of the dynamics of assimilation of a training material.

The Hurst exponent can be connected with the coefficient of normalized range R/S where R — a range of the corresponding time series, S — a standard deviation. Let's consider an algorithm of calculation of The Hurst exponent for a one-dimensional time series $\xi(n)$:

There is a one-dimensional time series $\xi(n)$ where n — number of some casual event corresponds to a discrete instant of t(n).

1. Let $\xi(n)$ be a quantity of cross-disciplinary concepts, that are connected with assimilation of one key concept, on n step on selection by length k , where k is the period of sampling of all time frame of T , given for studying, including classroom and unsupervised activities. Frequency of sampling is equal: $k = \frac{T}{n}$, n is the number of measurements.

The number of the acquired concepts is defined by quantity of truly solved tasks.

2. We define the mean value of a measuring on n step during sampling of k :

$$\bar{\xi}(n, k) = \frac{\sum_{j=1}^n \xi_j}{k};$$

3. We define a deviation of a number of measurements $\xi(n)$ from the mean value:

$$X_j(n; k) = \xi_j(n) - \bar{\xi}(n; k);$$

4. We find a range:

$$R(n; k) = \max_{r \leq n} \sum_{j=1}^r X_j(n; k) - \min_{r \leq n} \sum_{j=1}^r X_j(n; k);$$

5. We define a standard deviation of the considered time series:

$$S(n;k) = \sqrt{\frac{\sum_{j=1}^n (\xi_j - \bar{\xi}(n;k))^2}{k}};$$

6. The Hurst exponent is defined from the formula

$$\frac{R}{S} = \left(\frac{n}{2}\right)^H;$$

7. Communication of The Hurst exponent and dimension D of Hausdorff-Bezikovich is expressed by equality $D=2-H$.

The following stage is the development of an assessment technique of the synergetic effect of knowledge and activity integration, based on the process of educational elements assimilation. The most universal mathematical model of assessment of the synergetic effect of knowledge and activity integration is the model, in which cumulative effect of any activity is expressed as the sum:

$$E = E_s + \sum_i E_i$$

where E is a cumulative effect of educational cognitive activity, E_s is a synergetic effect, E_i is an effect of educational cognitive activity at assimilation i, that is an element of mathematical knowledge.

A synergistic effect can be expressed in the following aspects:

- at the same amount of time, which is allowed for studying the structural elements of mathematical knowledge, there has been increase in the knowledge volume and achieved the possibility of "hidden knowledge", objectively existing, but subjectively unknown to the trainee. This cumulative effect is formed due to completeness of formation of abilities to operate with concepts in the solution of applied and professional tasks by means of establishment of cross-disciplinary communications at more deep levels of integration;
- at the same intellectual, physiological, informational resources dialogue of mathematical, scientific, humanitarian and informational cultures provides high-quality enrichment of intellectual operations, streamlining of contents and structure of cognitive experience, efficient development of research activity, self-control of personal lines of the student during learning the composite knowledge structures [Dvoryatkina (2016)].

Geometrical representation of a distribution in frequency of conceptual space is the cornerstone of the technique of estimation of size of synergetic effect. The closed set on the

plane limited by the circle, which is circumscribed around an equilateral triangle, represents the figure, that allows estimating volume of knowledge. This volume of knowledge is in the vicinity of the central core and includes both the obviously mastered material (obligatory, provided) and the conditionally mastered material (not obligatory, variable), that gets into the field of development in a random way (fig. 1).

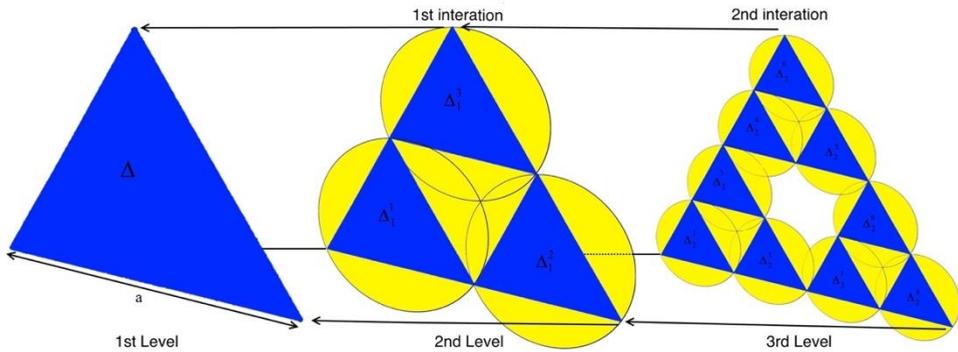


Figure 1. Geometrical representation of synergetic effect on the example of fractal conceptual model

The sum of differences of the areas on each level between the area of a circle (the minimum area containing a triangle) and the area of a triangle (the structural part of the Sierpinski triangle, which corresponds to one conceptual unit) represents assessment of the size of synergetic effect:

$$E_s = \sum_{j=1,3} (S_{okp_j^j} - S_{\Delta_j^j}) + \sum_{j=1,9} (S_{okp_j^j} - S_{\Delta_j^j}) + \dots + \sum_{j=1,3^n} (S_{okp_j^j} - S_{\Delta_j^j})$$

where the area of the circle is calculated through the side of the inscribed equilateral triangle with the side a , taken for one conventional unit. For example, at the first iteration the side of one of the three triangles is equal $1/2 \cdot a$, at the second — $1/4 \cdot a$ etc.

High-quality enrichment of ideational operations through formation of knowledge hierarchy, streamlining of contents and structure of cognitive experience, strengthening of communication and social interaction of subjects on the basis of dialogue of cultures, development of research activity, efficient self-control of personal lines of the student, strengthening of motivation of trainees will serve as a form of expression of a synergetic effect in the conditions of integration of mathematical, informational, scientific and humanitarian knowledge.

3. Results of the research

Computer monitoring of students' knowledge based on the fractal methods involves the ATS following components:

- cross-disciplinary fractal and organized base of key mathematical concepts;
- the informational model for tutoring process automation is presented in the form of bank of educational and cognitive and research tasks which is coordinated with fractal structure of a conceptual framework;
- the program module focused on individual estimation of quality of educational students cognitive activity in two parameters: depth of knowledge based on The Hurst exponent and the size of synergetic effect of educational cognitive activity.

So, on the basis of the educational thesaurus the informational model for tutoring process automation presented in the form of a matrix of educational and cognitive problems in mathematics is formed. Promotion of the matrix allows to calculate probability of stay at the particular level of development of contents taking into account depth of fractal representation of educational elements and to automatically make correction of the direction of granting to consideration of the proposed material horizontally and vertically. Horizontal levels establish realization of dialogue of mathematical, humanitarian and naturally scientific cultures in the course of tutoring according to the first iteration of fractal structure of an educational element (concept): mathematical profile, naturally scientific profile, humanitarian profile. Vertically we allocate levels of digestion of training mathematical material according to further body height of fractal sets: founding of mathematical knowledge; basic fundamental mathematical knowledge; level of all-vocational training (ability to apply mathematical knowledge in annexes to the sphere of professional disciplines); level of practical self-realization (personal and professional self-consciousness, self-rating and self-development).

The model allows to correlate complexity and volume of educational information with intellectual opportunities of the trainee, level of his competence and to choose the corresponding tasks. Information on results and parameters of realization of tasks is automatically brought in accumulative bank of information on users. Realization of the majority of tasks of all levels on a vertical and a horizontal allows to receive the maximal degree of fullness of volume and depth of specification of an educational element.

Within informational model of tutoring and the allocated levels the program module of assessment and diagnosing of success of students is formed. For activation of the qualimetric device it is necessary to define intensity and dispersion of the probability processes bringing system from one state into another which is characterized by a number of parameters, in particular rate of accumulation of educational information. Application of

the theory of fractals allowed to solve this problem. On the basis of the offered algorithm the program module in the C# programming language was developed for determination of coefficient of depth of assimilation of a concept and the mechanism of assessment of size of the synergetic effect of integration of knowledge and activity (fig. 2), focused on diagnostics of quality of knowledge of two parameters — individual estimation of depth of knowledge (D) and assessment of size of synergetic effect (Es).

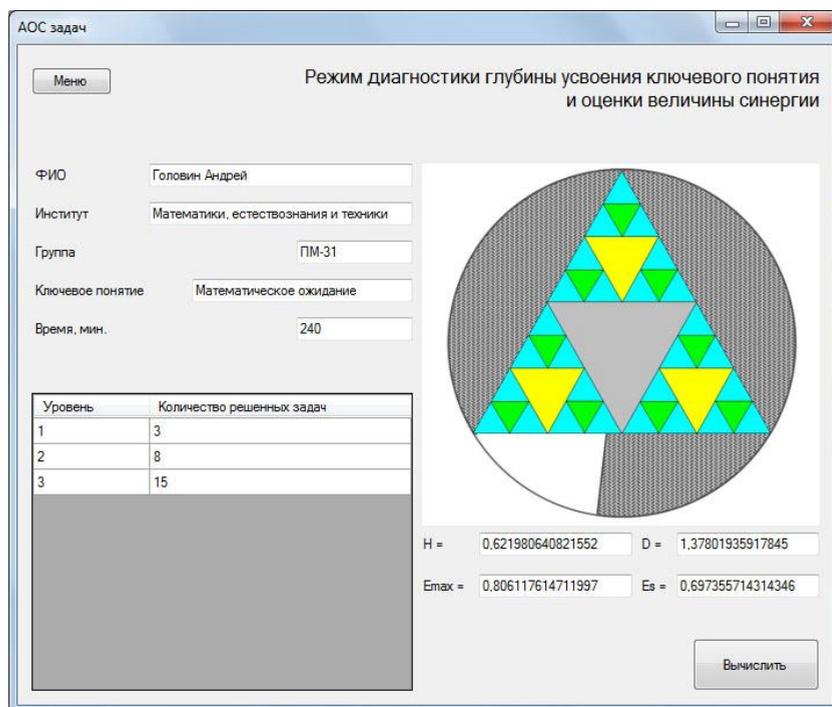


Figure 2. Module of monitoring of mathematical knowledge

The choice of a key concept, the common time allowed for studying of a concept, quantity of the acquired concepts during sampling (k) are loaded automatically from the ATS Artificial intelligence block. Due to the fact that Ai block projected and calculated not only the quality of the learning material (completeness and extent of its assimilation, completeness of assimilation of communications of concepts with other concepts, etc.), but also the number of iterations on fractal representation of mathematical concepts which were used by the student. The visual representation of this module applies the ratio transformation of the calculated values to strengthening of obviousness and simplification of perception of information by the nonspecialist in informational technologies:

$$k = \frac{(4 \cdot \pi - 3 \cdot \sqrt{3})/12}{E_{\max}}.$$

For three levels of digestion of training mathematical material this coefficient is approximately equal $k \approx 0,7619$. For further internal calculations not scalable data are used.

4. Discussion and conclusion

The considerable didactic value of the developed diagnostic technique consists in the fact that application of fractal methods in projection of technology of knowledge monitoring gives the chance to increase the accuracy and speed of level evaluation of students proficiency with the possibility of identification of synergetic effect. Fractal methods for diagnostics of results of tutoring promote assimilation and fixing of cross-disciplinary knowledge, activation of various ways of information perception, excluding the possibility of mechanical learning of conceptual material, unilaterality of development and impoverishment of the emotional sphere of future experts. In development of computer monitoring of knowledge the fact that evaluation test of students tutoring (carried out on the basis of two parameters — coefficient of depth of assimilation of a concept and its interrelation) with other concepts and assessment of synergetic effect of knowledge integration and activity of trainees is essential.

Thus, the technology of assessment activity on the basis of fractal model operation of mathematical structures allows increasing effectiveness, reliability and a validity of system of a qualimetrica of educational process.

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An educational software for teaching soil consolidation

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Abstract

The educational tool SICOMED_3D has been created to simulate problems of soil consolidation by prefabricated vertical drains. Thanks to its nice interface of windows, the introduction of data is very fast and easy for the students, while providing users with simple handling and powerful calculations. Its graphical environment allows to get representations of the excess pore pressure, local settlements and total surface settlement. SICOMED_3D can also generate an animation that recreates the evolution of the surface settlement during the consolidation process. The software presents, like commercial softwares, the most common options (e.g., save and open cases files, save animations and representations, etc.). Although the program is created to be used in several fields, among others as an engineering or research tool, the main use of interest for this work is for educational purposes. Another important application is as low-cost laboratory practices, as students can experiment by modifying the soil properties, including the depth of penetration of the vertical drain, in a quick, simple and intuitive way.

Keywords: *educational software; teaching in civil engineering; applied soil mechanics; consolidation by prefabricated vertical drains.*

1. Introduction

One of the main questions that appear when teaching in a Civil Engineering Master is what would be the best tool for students to understand the standard known problems of reference in soil mechanics. Given the extensive experience of the research group components in the numerical simulation of soil consolidation problems [García-Ros (2016)], using the network method and the Ngspice code, the idea of developing a software with a friendly environment to enable students to understand this difficult problem was carried out.

Nomenclature

$c_{v,x}$	horizontal coefficient of consolidation in X direction ($m^2 s^{-1}$)
$c_{v,y}$	horizontal coefficient of consolidation in Y direction ($m^2 s^{-1}$)
$c_{v,z}$	vertical coefficient of consolidation ($m^2 s^{-1}$)
t	time (s)
u	excess pore pressure ($N m^{-2}$)
u_o	initial excess pore pressure ($N m^{-2}$)
x, y, z	spatial coordinates (m)

The network method is firstly based on the electrical analogy and it is detailed in several engineering books and research articles: González-Fernández (2002). In addition, it is used as an educational tool to explain the relationship between mathematical models and physical and engineering processes: Sánchez-Pérez et al. (2016). This procedure, analogy between equations and physical problems, is an undoubted educational subject since many engineering or physical models use the same differential or partial differential equations: Mills (1999). The successful use of educational software in classroom experiences has been presented in previous works: Sánchez-Pérez and Alhama (2016).

In this work is presented SICOMED_3D [García-Ros *et al.* (2016)], a software capable of simulating 3-D soil consolidation problems with prefabricated vertical drains and its use as educational tool. The software has been created by the “Network Simulation” research group of the Universidad Politécnica de Cartagena.

Although the program SICOMED_3D is created to be used in several fields, among others as an engineering or research tool, the main use of interest for this work is for educational purposes. Another important application is as low-cost laboratory practices, as students can

experiment by modifying the soil properties, including the depth of penetration of the vertical drain, in a quick, simple and intuitive way.

Finally, SICOMED_3D, which makes use of the analogy or equivalence between the electric transport and the water movement in a porous soil due to an excess of pore pressure, is presented to the user through a pleasant communication environment, type windows, leading to "step by step" actions and with multiple options in data entry, file creation, simulation options, obtaining and representing results, etc. The network model files created by SICOMED_3D are executed in the Ngspice software, whose simulation results can be directly consulted through the various graphic representations available: excess pore pressure, local and surface settlements, average degree of consolidation, etc.

2. Mathematical model

This program reproduces the consolidation of anisotropic soils with partially penetrating vertical drains with a rectangular layout. The flow of water is in the upward direction (towards the soil surface) and horizontally towards the vertical drains, as shown in Figure 1.

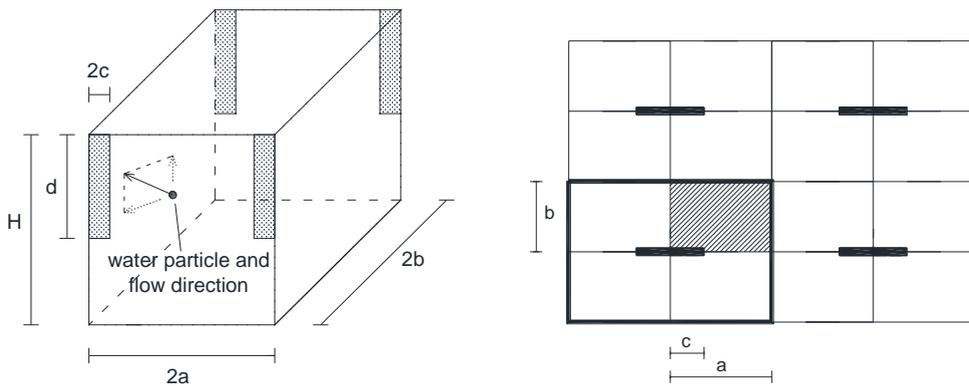


Figure 1. Physical scheme of the 3-D consolidation process with vertical drains.

For the typical section, the mathematical model is governed by equations:

$$\frac{\partial u}{\partial t} = c_{v,z} \left(\frac{\partial^2 u}{\partial z^2} \right) + c_{v,x} \left(\frac{\partial^2 u}{\partial x^2} \right) + c_{v,y} \left(\frac{\partial^2 u}{\partial y^2} \right) \quad (1)$$

$$u_{(x,y,z=0,t)} = u_{(0 \leq x \leq c, y=0, 0 \leq z \leq d, t)} = 0 \quad (2)$$

$$\left(\frac{\partial u}{\partial n}\right)_{\text{rest of the boundaries}} = 0 \quad (3)$$

$$u_{(x,y,z,t=0)} = u_0 \quad (4)$$

Where (1) represents the governing equation, (2) and (3) the boundary conditions and (4) the initial condition.

3. SICOMED_3D

The organization and structure of the program has been designed so that the student have a powerful and useful calculation tool, with a simple introduction of data and interpretation of results. Figure 2 shows a simplified scheme of the basic operation of SICOMED_3D.

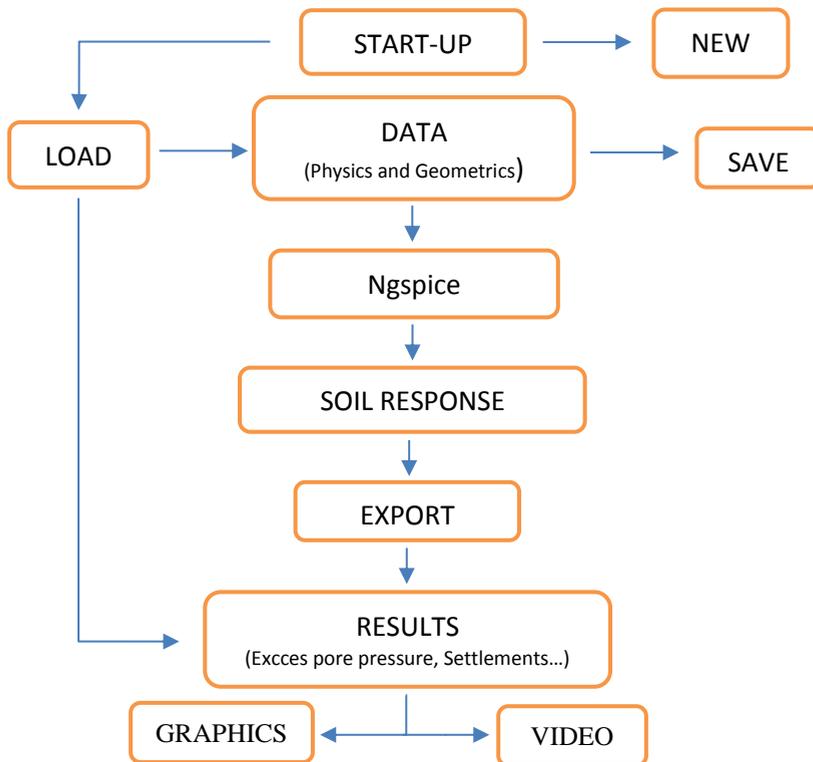


Figure 2. Simplified flow diagram of the program.

Data entry is done through a graphical interface consisting of a total of three windows, which appear consecutively as the data entry is completed. In the first screen, Figure 3, the data related to the geometry in plant of the problem (total length, total width and width of the drain) are introduced, as well as the reticulation, which will allow us to obtain a better precision in the calculations the greater this one.

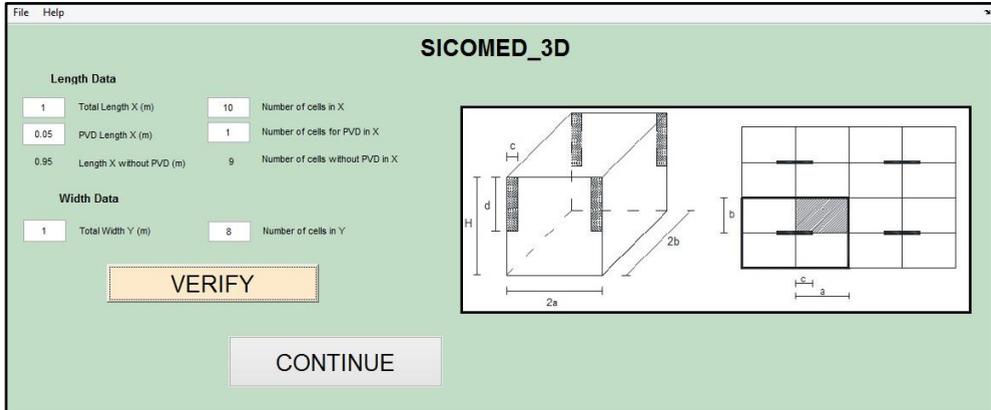


Figure 3. First data entry screen.

In the second screen the data related to the geometry of the strata, as well as the coefficients of consolidation, are introduced. The program allows the definition of up to 3 different layers, which allows students to experiment and understand the phenomenon of consolidation by varying the properties of these. Moreover, through a dropdown tab, the student can choose the depth of penetration of the drain, checking the influence that this can have in the phenomenon of consolidation.

Finally, in the third screen, the parameters related to the simulation required by the program are introduced: surface applied uniform load (N/m^2), initial time from which results are desired, final calculation time, maximum time increment between each iteration and a relative tolerance parameter that uses the Ngspice program to reach the convergence of the problem. Once all this data has been entered the simulation can start, using the calculation button. Figure 4 shows a capture of this third data entry screen.

Simulation Data

Uniform Load
25000 (N/m²)

Initial Time 0 (Years) Final Time 5 (Years)

Time increment for each iteration (approx.)
0.01 (Years)

RELTOL (determines convergence across iterations)
0.001

BACK RUN

Figure 4. Third data entry screen.

At the end of the simulations students can have a visualization of the results graphically. The program offers up to 6 possibilities of representation of results (one of them includes a video animation that shows the evolution of the surface settlement), which are selected through a dropdown tab. In this way, the student can know the information sought in a simple, fast and accurate way. The following section shows some of these graphics.

4. EXAMPLE OF LEARNING WITH SICOMED_3D

Since 2012, the CIETAT Master has been taught at the Universidad Politécnica de Cartagena, focused on water and soil engineering. In the course "Soil Mechanics", the students have to deepen in the most relevant concepts of this discipline, a task that is not simple and that needs the appropriate tools to achieve the success of teachers and students. In the case of soil consolidation, the SICOMED_3D program, developed by the "Network Simulation" research group, stands as a very useful tool to facilitate student learning, which deepens in this part of the soil engineering through experimentation with fast computer simulations.

A set of real consolidation scenarios is proposed, from which the students will determine the soil parameters (thicknesses, hydraulic conductivity, pore index, etc.) and other necessary information to be subsequently introduced into the program and run the calculations.

The students then have a wide range of possibilities in the graphical representation of results: the program allows obtaining both the excess pore pressure (Figure 5) and the local

settlements for one or two columns of soil (chosen from the values of its X,Y coordinates) in the desired time interval. It is also possible to know the values of these unknowns for any point on the soil (from its X,Y,Z coordinates), the accumulated surface settlement (for one or two columns of soil) and the average degree of consolidation on the whole medium (Figure 6). Finally, by means of a powerful graphic animation, it is possible to check how all the surface settlements are produced, as the consolidation process advances (Figure 7).

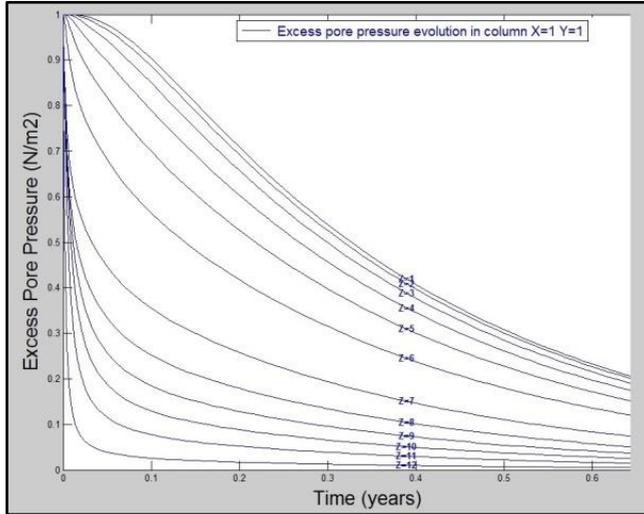


Figure 5. Excess pore pressure evolution in a column of the soil.

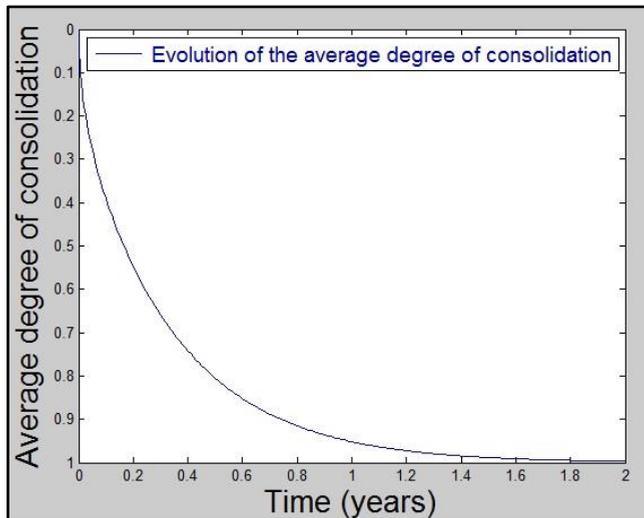


Figure 6. Average degree of consolidation.

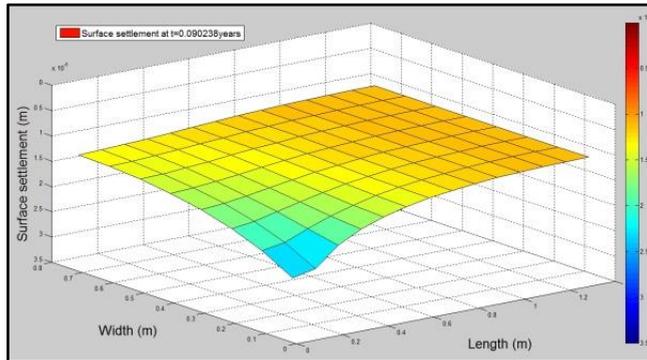


Figure 7. Capture of the animation of surface settlements evolution.

5. CONTRIBUTION

The educational tool SICOMED_3D, created to simulate problems of soil consolidation by prefabricated vertical drains, provides the student of Soil Mechanics of the UPCT CIETAT Master with a tool that greatly facilitates the understanding of this soil improvement technique through experimentation. Supported by a pleasant graphical environment, the program provides a wide range of results, which the user can consult in a quick and easy way. The scenarios modelled with SICOMED_3D will be explained in class to check the student's understanding of the problem.

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Self-learning of the direct soil tomography problem using a specific educational software

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Abstract

The educational tool DITPRO has been created to simulate problems of direct soil tomography problem. The introduction of data is very easy for the students, because the software has an interactive grid window. Moreover, provides to the users an easy handling and powerful calculations. Its graphical environment allows access to a graphical representation of potential functions. The software presents, like commercial softwares, the most common options (e.g., save and open cases files and representations, etc.). Although the program is created to be used in several fields, among others as investigation tool, the mainly use of interest for this work is as educational tool. Another important use is as low-cost laboratory practices. The student has the possibility to obtain system information of the Spice code text file, whose rules are well known by students with knowledge of electrical circuit theory. The student must to design and implement several sceneries and explain it to check his/her understanding of the problem.

Keywords: *educational software; teaching in engineering; design mathematical models; Spice code; Soil tomography.*

1. Introduction

Faced with the possibility of teaching in a course of Engineering Master, the main question that appears is what would be the best tool for students to understand the different water and soil engineering problems. Given the great experience of the research group components in numerical simulation using the network method and Spice code, the idea of developing different softwares with a friendly environment to allow students the understanding of these difficult problems arose. Although the software can be used by any student learning soil engineering, the main careers to which is focused are civil and building engineering.

The network method is firstly based on the electrical analogy and it is detailed in several engineering books. On the other hand, it is used as an educational tool to explain the relationship between mathematical models and physical and engineering processes [Sanchez-Perez *et al.* (2016a)]. This procedure, analogy between equations and physical problems, is an unquestionable educational subject since many engineering or physical models use the same partial or differential equations. [Mills (1999) and Chapman (1960) and González-Fernández C.F. and Horno J. (2002)]. In previous works have been presented the use successfully of educational softwares in classroom experiences [Sanchez-Perez and Alhama (2016)].

In this work is presented a software capable of simulating 2-D, direct tomography problem: DITPRO [Sanchez-Perez *et al.* (2016b)] and its use as educational tool. The software was created by the research group “Network Simulation” of the Universidad Politécnica de Cartagena.

Although DITPRO is created to be used in several fields, among others as investigation tool, the mainly use of interest for this work is as educational tool, allowing to explain the relation between physical processes and mathematical equations of the model. Another important use is as low-cost laboratory practices.

Finally, DITPRO, which makes use of analogy or equivalence between electric transport and transport of current in soil is presented to the user through an environment of pleasant communication, type windows, which leads to actions "step by step" and possible options such as selection and problem definition, data entry, file creation and manipulation of models, simulation options, advanced simulation, presentation of results, etc. Files network models developed by DITPRO run in Spice softwares and the simulation results are provided directly in the graphical environment or through appropriate manipulations, in the graphical environment of the program itself.

2. Theoretical basis of direct problems in tomography

The electrical tomography is a tool whose purpose is to determine the resistivity for the characterization of the subsoil. The process consists in introducing a continuous electric current into the ground through a pair of electrodes (current) that are located in determined positions, measuring the difference of potential (d.d.p.) in specific locations, by another pair of electrodes located on the surface of the terrain. This d.d.p. is caused by the input current. From the value of the applied current and the measured voltage, the application of the law of Ohm allows to determine the apparent resistivity of the subsurface, characteristic parameter of each type of material.

In tomography, the direct problem is to find the distribution of electric potentials and currents throughout the domain, particularly on the surface of the terrain, from the properties and geometry of the medium and the boundary conditions, a potential difference between two points. From the set of aligned points where the surface electrodes are placed, generally symmetrical with respect to the vertical that separates the domain into two equal parts.

For this boundary condition, the cells in which the potentials are applied must be sufficiently far from the side and bottom boundaries for this condition to be satisfied; Thus, L_a is the distance between the point of application of voltage V (+1 or -1) and L_b is half the horizontal length of the domain, Figure 1.

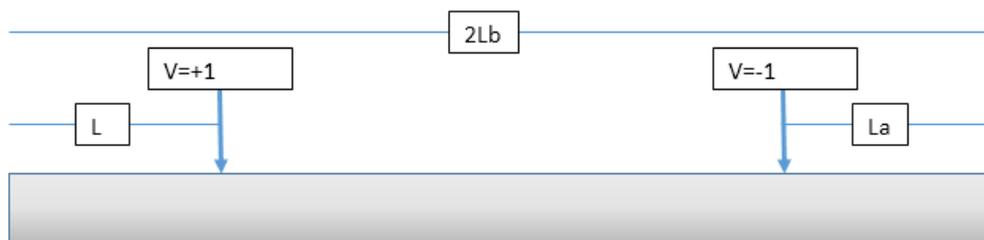


Figure 1. Measurement diagram of the tomograph

The solution of the direct problem and the model allows the visualization of both current and equipotential voltage lines and the analysis the patterns distortions of these lines associated with the presence of layers, subregions, holes ... of different electrical conductivities. Notice that the problem is reduced to the study of the electric fields that are created in the half-space of an electric dipole, that of the ground. The other half space is assumed to be null conductivity.

On the other hand, the 3-D effect is neglected in this software, this is equivalent to assuming that our results would be valid for 2-D problems, that is, the potentials (+1 and -1) would apply to two infinite lines perpendicular to the surface of the domain and over the

surface of the terrain. The potentials of the centers of each cell are read directly in the output file whereas the electric currents (which can also be read from the output file since they are the currents in the resistances of the cells) are obtained more directly by drawing the gradients of the equipotential curves.

3. DITPRO

Figure 2 shows a simplified scheme of the basic operation DITPRO. Its implementation gives access directly to the input data: geometry crosslinking, physical characteristics, boundary conditions, etc. Once completed the specification of the problem can create a basic text file model that allows direct manipulation and modification. Because of all this, DITPRO provides to the users an easy handling and thanks to spice code, powerful calculations.

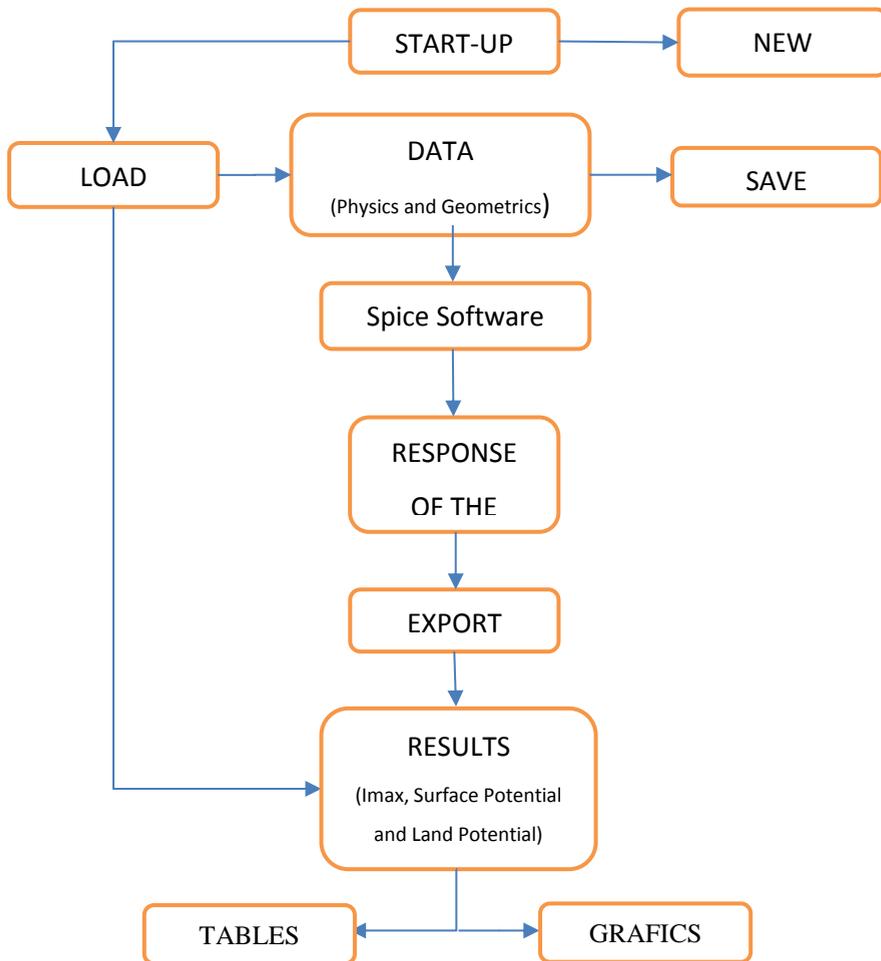


Figure 2. Simplified flow diagram of the program.

The introduction of data is very easy for the students, at the start of the DITPRO software, the main window is opened, where the information necessary to perform a simulation by direct problem analysis in soil electrical tomography is entered. The basic data to be supplied to the program are: Number of diodes, Separation between diodes, Depth of terrain to be studied, Parameters Geometric (width of vertical regions and amount and thickness of layers or extracts within the terrain) together with a mesh factor f_a , f_b , f_c , f_1 , f_2 and f_3) to each of these, and the value of the physical parameters of each region. All the data are introduced as appropriate screens such as those shown in Figure 3. All this information and more is detailed in the “Help” windows.

After this data has been entered, the type and quality of the required result (Maximum Intensity, Surface Potential and potential in the field in low or high quality) is selected and the software is executed. Automatically the program will perform multiple simulations by varying the position of the active diodes from the central diodes and with each simulation opening towards the next until reaching the extreme diodes or maximum opening.

Once the model has been numerically solved in the Spice code, the screen “Simulation results” is shown. The graphical environment DITPRO allows access to a graphical representation of maximum intensity, surface potential and land potential. Access to these representations is straightforward once simulated the model.

It stores the results obtained from the simulations in an ".xls" format file in which the first column of the results represents half the distance between the active diodes ($d/2$) and the second column is the measured value. On the other hand, DITPRO incorporates a graphics presentation using Matlab, Figure 4. Moreover presents, like commercial software's, the most common options (e.g., save and open cases files, save animations and representations, etc.).

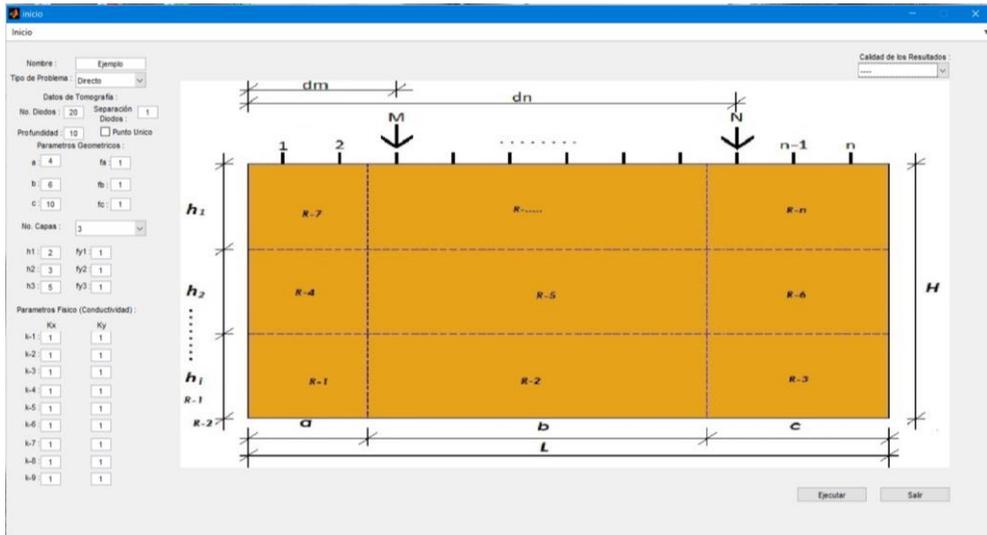


Figure 3. Editing geometrical and physical parameters of the problem.



Figure 4. Results graph options

The dependability and efficiency of the Spice code has been probed by a great number of works in different fields of engineering, such as heat transfer, chemical, elasticity and so on, already published in the scientific literature.

4. Proposal for useroom in class: direct problems in tomography

Master course of CIETAT devoted to water and soil engineering has been teaching since 2012 in the Universidad Politécnica de Cartagena. In the part of the terrain, the students are introduced in the equations that characterize it. From the network simulation group, we discussed how to facilitate the learning of these systems. The result is DITPRO software.

For the proposal of use in classroom, the student can propose and solve many scenarios. The student must determine the real parameters (physical characteristics, initial conditions, location of the connection points of the electrodes, etc.) that are required to define the tomographic problem and access the simulation as if it were a field work.

The main parameters to introduce are the electrical capacity of the subsoil (or its layers), property that has the bodies associated with the retention of electric charge in its inside, electrical conductivity, the ability of the ground to allow the passage of electric charges through it, point of application of the excitation electrodes, are the points in the field where

the constant current power source will be applied and time, it is time of application of the load, necessary to reach a steady state. Figure 3 shows a land rectangular domain, points of application of voltage and all parameters to introduce.

Once the problem is solved by the software (Figures 5 to 8), the student must interpret the results and their association with the govern equation. Finally, each student must explain the meaning of the solutions obtained with the software and the physical meaning of it.

The evaluation of student's learning is done by posing a real problem that must be solved explaining each of the solution characteristics obtained and its application to the problem optimization.

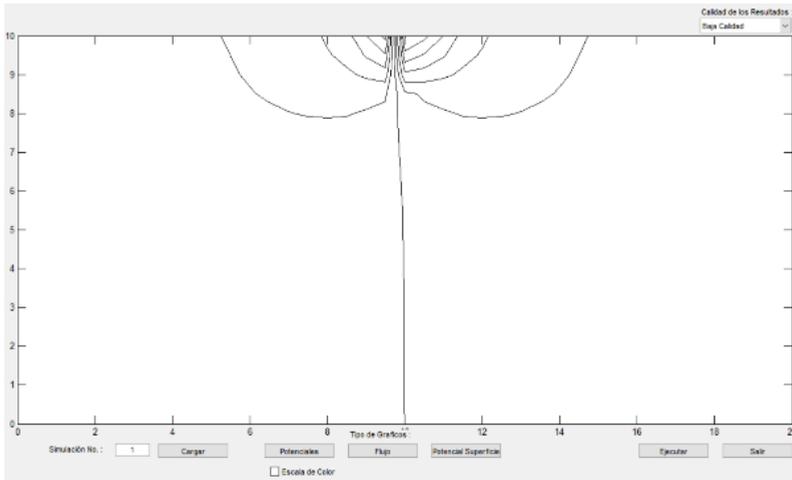


Figure 5. Potential in Land

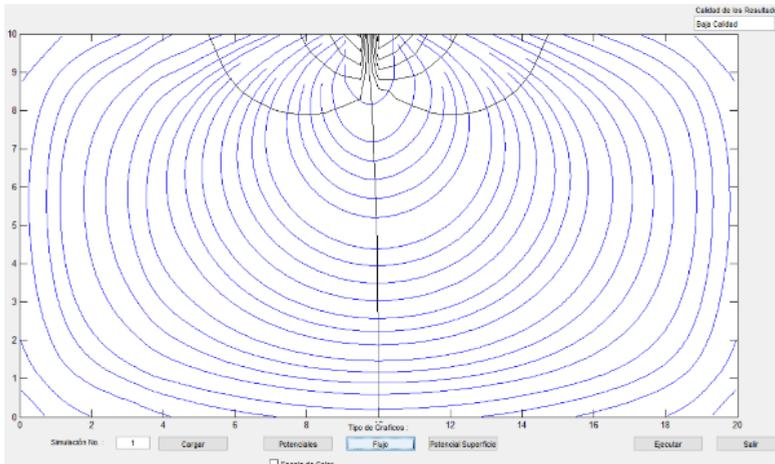


Figure 6. Potential and Flow

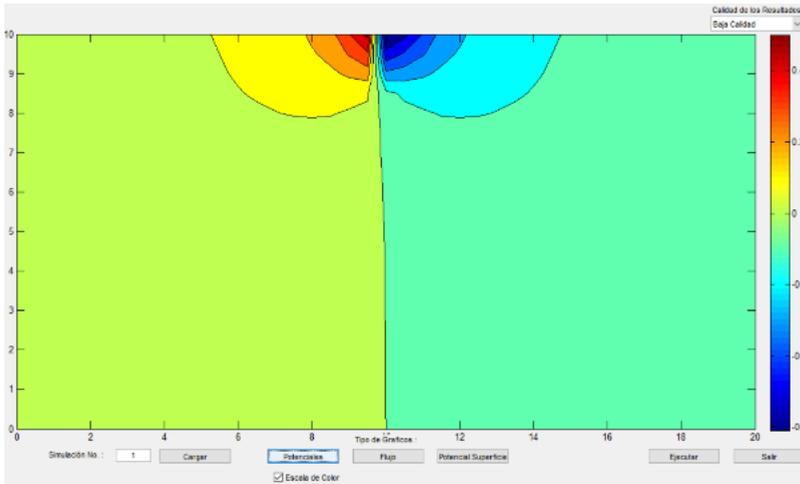


Figure 7. Potential with color scale

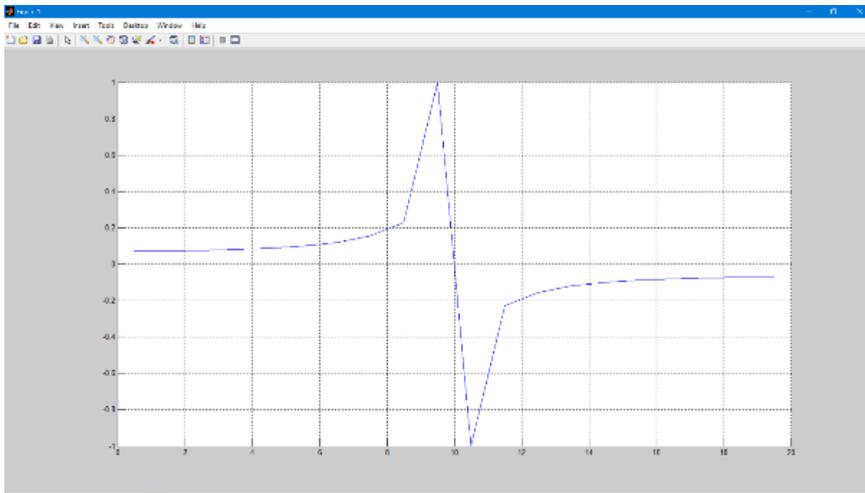


Figure 8. Surface Potential

5. Conclusion

The educational tool DITPRO has been created to simulate problems of direct problems in soil tomography, providing to the users an easy handling and powerful calculations. Its graphical environment allows access to different kind of graphical representation of potential. This type of learning tools designed for a specific problem facilitates the student's understanding of the problem. The student must to design and implement several real sceneries and explain it to check his/her understanding of the problem.

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Use of webcasting and development of critical thinking skills

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Abstract

The present contribution describes the results of a research carried out at the Laboratory of Experimental Research - Department of Education, Roma TRE University. Main aim of the research is to assess if it possible to increase critical thinking skills in university students, through meaningful online cultural insights in general and webcasting in particular. Students in Education attended part of the course "Methodology of Research" online, through a webcasting activity: cultural insights, guided discussions, videos, built on structured models, prompted reasoning, elaboration of ideas and knowledge connections. Students had the possibility to deepen knowledge and abilities linked to the themes of the course, but also to develop argumentation skill, communication and critical evaluation skill. The data analysis presented in this report were developed along the double diachronic and synchronic dimensions; the evolution of critical thinking skills has been verified by the lexicon-metric analyses of written production.

Keywords: *Webcasting; Critical thinking skills; Assessment.*

1. State of the art¹

The crisis which has been affecting the Western world during the last decades, indeed, force to the adoption of different solutions, especially in the field of Higher Education. The situation makes the realization of innovation necessary, but such innovation should support the development of new competences and skills, as reminded by the European Commission (*Rethinking Education*, 2012). The aim of integrating digital resources and opportunities in education has to be seen in the light of 21st century learning: in their work titled “21st Century Skills: Learning for Life in Our Times” (2009), Trilling & Fadel create a framework of cross-sectional skills necessary to prepare society for the complex 21st century reality : critical thinking, creativity, communication and collaboration (the 4 C’s) are considered as pivotal for realization and personal development, active citizenship, social inclusion and employment.

The development of such kind of abilities and skills cannot be solved with interventions based on the mere employment of technology. The culture of technology lacks depth, being characterized by the speed at which the various technical solutions follow each other on the market. It is necessary to find a coherent and effective system of connection between the promotion of skills in a lifelong learning prospective and the transitory function of technological tools (Vertecchi, 2012).

One of the main problem we are facing at the moment is that of a general lack of researches in the field of webcasting use in Higher Education and transversal skills promotion. As Traphagan et al. states (2009), webcasts or podcasts are mostly used in higher education as broadcasting lectures, delivering recordings of in-class lectures, guest lecturers and as supplementary video learning materials for self-study. Some studies have underlined that webcasting and podcasting use in higher education can develop cognitive understanding through motivation and engagement (Oliver, 2005) and information processing (Hargis and Wilson, 2005), but only a limited amount of research highlights the connection between students’ transversal skills promotion and webcasting use; therefore, part of them refers only to student attitude and student behaviour (Kurtz et al., 2007; Giannakos and Vlamos, 2013).

The purpose of the present study is to demonstrate that technology in general and webcasting in particular, if used adopting criteria based on a structured reference model, are able to provide a stable architecture for further study and to promote the construction of a responsible and critical conscience in the young generation. As Poce states (2012) “the

¹ A. Poce coordinated the research presented in this paper. Research group is composed by the authors of the contribution that was edited in the following order: A. Poce (State of the art, Research Hypothesis and objectives, Critical thinking framework, Conclusion), F. Agrusti (Measure language complexity, Results), M.R. Re (Methodology).

ability to evaluate critical thinking skills is essential in facing the urgent need for renewal and innovation, especially in education, and establishing policies aimed at increasing social welfare". Create a connection between distance learning and such kind of skills can strongly contribute to the construction of effective teaching and learning activities, in a lifelong learning prospective.

2. Research Hypothesis and objectives

The present research points at investigating, mainly, if:

1. it is possible to create online teaching and learning resources, taking into account the relation process/content in the terms of developing students' critical thinking skills;
2. however, in a situation that is not a face-to-face one, it is possible to establish the integration between online and written message that webcasting allows with easy accessible tools;
3. the use of webcasting supporting traditional teaching and learning improves learning levels of Higher Education students.

The main objectives of the research activities are the following: 1) to define a webcasting learning model thanks to which develop critical thinking skills in university students; 2) to organize and coordinate students' guided discussion on a devoted virtual space; 3) to measure students' critical thinking skills through lexicon-metric analysis and a specific assessment tool which adapt Newman, Webb and Cochrane (1997) model.

3. Methodology

About 250 students in Educational Sciences (Department of Education, Roma TRE University) attended, during the academic year 2015/2016, part of the course *Methodology of Research* through a webcasting activity on *Orbis dictus* VLE (Vertecchi, et al., 2010). On this platform, six lectures, on some passages taken from Rousseau, *Émile ou De l'éducation* (1762), were webcast. These lectures were organized by reproducing a model that proved successful at Bologna University in medieval times, and has been replicated in different contexts, including today's (Poce, 2012): 1) *distinctio*: presentation of the subject; 2) *divisio textus*: analyses of the constitutive elements of the text; 3) *collatio*: pros and cons discussion between students and the online tutor; 4) *questio*: global and critical interpretation of the text. Each passage was presented considering the above phases.

The *collatio* and the *questio* phases were carried out through the Forum section on *Orbis dictus* platform. Each student was asked to present, after the video visualization, her/his comments about the themes and the central elements of the video itself and start a

discussion under the guide of the online tutor. For each video, an online discussion has been developed and about 250 students have interpreted, presented questions and new ideas, argued, analysed and critically interpreted the six lectures/videos in webcasting format. During the project, an online tutor moderated the discussion. The tutor was responsible for keeping in touch with participants, motivating students in the activities, according to the time schedule, directing the discussion towards the achievement of a specific learning objective, while briefly summarizing the key points that emerged in each discussion. The project has entailed the use of a content analysis model able to measure the critical thinking contribution provided by the students when they were engaged in the production of written text during the *collatio* and *questio* activities. The data analyses on the texts produced by the participants were developed to verify if any improvement in students' critical thinking skills occurred and if the use of webcasting really helps Higher Education students learning levels. To conduct such analyses, two research tools were used: 1) a survey to indicate the descriptive data of participants. To promote an individualized approach centred on defined didactic objectives, we created a student profile with the most frequent values, which provided the operative instructions to the research group; 2) lexicon-metric analyses of the written productions of students. All the written materials produced by students were analysed in-depth to measure students' language complexity in relation with the critical thinking framework identified by Newman, Webb and Cochrane's model (1997) and described below in detail. The issue related to the analyses of the text produced online by students has already been discussed on several levels (Poce, 2012; Poce et al., 2015). Marra et al. (2004) carried out an investigation of the analysis models available and identified the one developed by Newman, Webb and Cochrane, as the most comprehensive to evaluate the quality of online interactions, implemented within a discussion forum active for university students. As stated above, in this contribution, such model was adapted and used for the analysis. The following two paragraphs describe the tools in detail and give reasons for the choices employed.

4. Critical thinking framework

As stated above, the current study employed an adapted version of Newman, Webb and Cochrane model to assess critical thinking contribution by the students in the text provided during the *collatio* and *questio* activities. Critical thinking skills are fundamental requirements for those who attend a degree course and are requested to use the knowledge acquired to generate new knowledge in a logic structure. If there is absence, or worrying lack of the possession of such skills, interventions are needed. A cultivated critical thinker can be identified (Paul and Elder, 2012; 15) as one who: raises vital questions and problems, formulating the clearly; gathers and assess relevant information and effectively interprets it; comes to well-reasoned conclusions and solutions; think open-mindedly within alternative system of thought, recognizing and assessing; communicates effectively with others in figuring out solutions to complex problems. The researcher used an assessment tool, already tested, which contains the criteria adopted to assign the student's written production to the critical thinking categories. The assessment of the evolution of critical thinking skills was carried out through lexical analysis of the written production by the students. Each text measure has been used to assess one or more categories of the critical thinking skills mentioned above.

Table 1. Critical thinking skills categories

Category (Indicator)	Definition	Encoding rules
Justification	Argumentation of one's own proposals and solutions.	Proofs of justifications in favour of the solutions found or for the opinion expressed are present (+) or not (-).
Relevance	The fundamental issue required by the question is mentioned.	Relevant (+) or no relevant (-) statements or digression.
Importance	Knowledge of the topic (important facts related to the topic are mentioned).	References to important or no important issues to answer the question appropriately are present (+) or not (-).
Critical evaluation	Personal and critical elaboration of sources, background and ideas.	Critical evaluation of the idea proposed is present (+) or not (-).
Novelty, new ideas	New information, new ideas and solutions to the issues raised in the question are provided.	Further information, new ideas, possible solutions to the problem are present (+) or not (-).

5. Measure language complexity

Language has a powerful effect on human relationships but at the same time it could be considered as an effective tool for manipulation and control. The branch of linguistics known as critical discourse analysis (CDA), or more commonly as critical linguistics, views language as a form of social practice. In the 1970s, just after the first developing of this interdisciplinary approach, it rapidly seemed important to researchers to raise the awareness about the link between ideology and language (Halliday, 1989; Fowler, 1996). Using some of the simplest lexical concepts present in literature, in this section some relevant text measures emphasizing the lexical aspects of language production are presented, in order to identify students' skills through a detailed analysis of their lexical choices. Hereafter some of the most used lexical measures are shown in lexical analysis. Several indexes are presented to compare the different texts collected: 1) *lexical density indexes*: these indexes measure the proportion of different words classes (in this preliminary research we are using adjectives, verbs and nouns) to the total number of tokens (all the words contained in the text) (Johansson, 2008). *Part of Speech (POS)* recognition is crucial for computing these indexes and in this research, we used an automatic tool to annotate texts with POS and lemma information called *tree-tagger*²; 2) *number and length of sentences*: these indexes measure how many sentences are contained into the *corpus* and the mean length of sentences (in words). Though this value is insensitive to structural differences within sentences, in literature it is recognized as a reliable indicator of grade level (Lu, et al., 2011); 3) *Type-Token Ratio (TTR)*: this index measures the ratio between how many different words are used (types) in relation with how much these words are repeated into the *corpus* (tokens). This index is dependent on the text size: it increases as texts contained in the *corpus* get smaller. Due to this, the comparison is not valid on different-sized texts unless probabilistic models and other statistical approximations are taken into account (Baayen, 2008). *Mean Segmental Type-Token Ratio (MSTTR)*. This index represents the simplest transformation of TTR, calculating the TTR on small segments of original texts and then taking the mean (Lu, et al., 2011). This index reduces the text size effect above mentioned.

² About tree-tagger software see: <http://www.cis.uni-muenchen.de/~schmid/tools/TreeTagger/>

6. Results

Table 2 shows main results for collected *corpora*. The type-token ratio did not provide any useful information since it is between .07 to .09 for each corpus. Considering for example *Video 1* and *Video 3 corpora*, the probability of encountering a new type at the end of the first corpus is 9 per cent, while in the second one this is only 2 per cent more likely. From the time that considered *corpora* were of comparable size, we obtained similar results with MSTTR index.

Table 2. Lexical diversity and density results.

Variable	Video 1	Video 2	Video 3	Video 4	Video 5	Video 6
Tokens	61211	66866	60411	51955	57078	65655
Types	5487	5074	4105	3920	4209	5252
Lemmas	3481	3197	2676	2578	2803	3294
Sentences	2301	2987	2504	2014	2478	2879
Avg. sent. len. (in words)	26.6	22.39	24.13	25.8	23.03	22.8
TTR	0.09	0.08	0.07	0.08	0.07	0.08
MSTTR	0.79	0.76	0.76	0.77	0.78	0.77
N ratio (%)	26.31	26.78	25.14	25.35	25.07	25.53
V ratio (%)	15.09	17.12	16.77	16.46	16.90	17.93
Adj ratio (%)	9.85	9.96	10.59	10.72	10.61	9.84

Source: Dataset collected by LPS research team in December 2016.

Lexical density was computed separately for nouns, verbs and adjectives, cumulatively for all texts in each corpus. The proportion of nouns is more than .25 in every corpus. There are fewer verbs in *Video 1 corpus* (.15) and more than .16 out of all tokens for other corpora. There is no significant difference is for the proportion of adjectives, varying from .09 and .10. These data suggest that there is a large amount of words carrying “nominal” information, whereas *Video 6 corpus* contains largest proportions of verbs. Since spoken texts tend to have lower lexical density (Halliday, 1989), we could assume that *Video 1* texts are closer to spoken language, while other *corpora* are closer to written language, although the difference is minimal. For what concerns the mean sentence length, there are on average more than 25 words per sentence in *Video 1* and *Video 4* texts (see table 1), and more than 21 words in an average sentence of other *corpora*. According to the Flesch’s analysis of the readability of adult reading materials (1974), the score for the first two *corpora* corresponds to style categories “difficult” and the other to “fairly difficult”.

7. Conclusion

The aim of this paper was to identify innovative ways to assess higher education students' critical thinking skills in online environments. The idea at the basis of the teaching and learning programme offered to the students was that of starting from meaningful online cultural insights in general and webcasting in particular. On one side, we introduced the assessment grid used for evaluating critical thinking skills level in students' written argumentation; on the other side, we presented a language complexity analysis of these text productions. As expected, the lexical diversity as measured by TTR did not reveal any significant difference in the vocabulary size between *corpora*. All the corpora displayed a similar amount of information wrapped in nouns, but *Video 1* language can be described as the more informal, because its lexical density is lower in general, and this can be due to the nature of the stimuli prompted in the video, which was essentially the presentation of the author of the text, object of the other videos. On the basis of average sentence length, *Video 1* and *Video 4* corpora can be described as "difficult-style" text productions, appropriate in higher education or adult learners' settings. More analyses are needed to understand connections, if any, between length and density indicators and critical thinking skills levels to be measured according to the adapted Newman Webb Cochrane (1997) model.

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Use of emerging technologies in flipped classes

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Abstract

The need for this innovation stems from the constraints of teaching an applied science course to a large cohort of approximately 500 students which makes it impossible to include practical activities. This was compounded by the fact that the course had students with different levels of science knowledge. The aim of our pedagogic innovation was two-fold: to make the basic concepts more understandable for a broad audience of non-science major students, while maintaining a level of difficulty and rigour sufficient to challenge and provide a sound basis for students from the Geosciences undergraduate program. We used a flipped classroom strategy supported by information and communication technologies. Material was provided online before the class so students could acquire basic concepts and identify gaps in their knowledge, and in the classroom the concepts were applied in group activities. Additionally we used the online quiz tool Socrative for students to self-assess their learning. This work was supported by post-class follow-up activities. As a result we observed a substantial increase in student motivation and engagement in their learning process and greater interaction between students and between students and teachers. Furthermore there was an improvement of overall performance with fewer students failing the course.

Keywords: *Flipped classroom; Siqua+ blackboard; Socrative quizzes; Learning appropriation.*

1. Introduction

The globalization and ready accessibility of information nowadays has forced a new educational model based on competencies where the student is expected to acquire autonomy and to appropriate the learning process. Colombia has until very recently followed a traditional education model and is now trying to move to a competency-based model that helps graduates to develop better skills for the professional environment and career development (Salas, 2010).

The Geosciences course at Los Andes University, Bogota, is the gateway to the Geosciences undergraduate degree, but it is also a basic subject taken as a science elective by a large number of students in programs as varied as engineering, social sciences and music. The challenge is to make this subject accessible to this large group of students while maintaining enough rigour to challenge and provide a sound basis for students from the Geosciences program. Geoscience, like all natural sciences, should be complemented by a practical or laboratory session, but this is not feasible for this course due to the large number of students (~500 per semester) and the small number of professors that the department has (7 at the moment of innovation). The Geosciences course covers a wide range of topics to understand the Earth, including the physical, chemical, and biological principles that explain the formation, structure, dynamics and history of our planet. Previous attempts have been made to make classes more dynamic by presenting rock samples, fossils, minerals and maps during the lectures (e.g. Millis, 2014); and while this may improve motivation, it is also not practical for large groups.

The main aims of our innovation were to make the course content accessible for very heterogeneous students groups and to improve their transversal skill set. We used the theoretical framework of the Socratic method, in which we asked the students specific questions which helped them create new knowledge and appropriate the learning process through their resolution (e.g. Chin, 2007).

The innovation was applied in half of the lecture sessions, and was divided into three modules addressing the traditionally more problematic areas using information and telecommunication technologies (TICs) that have been shown to improve concept comprehension (e.g. Badia 2006; González-Coma et al. 2015). The three modules included: one on plate tectonics, volcanos and earthquakes (M1), one on atmosphere, oceans, climate and paleoclimate (M2) and one on minerals, the rock cycle and the 3 basic types of rocks (M3). Each class within the module required the students to complete a pre-class activity which provided the theoretical bases for the development of in-class group activities following the flipped class strategy. The flipped class strategy consists of students actively gathering the information outside of class by reading, watching videos, or completing other activities and then in class, doing the kind of activity typically assigned as homework:

solving problems with their professors or peers, and applying what they learn to new contexts (e.g. Berrett 2012; Garza 2016; Wallace et al. 2014). Students were then required to do a post-class activity in order to reinforce the learning of key concepts, leading to long-term learning (e.g. Wallace, 2014).

Pre-class activities were uploaded to the University's SICUA+ virtual platform based on Blackboard Learn[®], which is easily accessible by all students. The methodology also introduced the use of Socrative (<https://socrative.com/>) for online quizzes. This tool was used for two purposes: first to give the teacher feedback on student concept acquisition; and second, to help students auto-evaluate their knowledge and thus improve the learning appropriation process.

This new strategy is expected to benefit students by giving them the opportunity to apply the concepts acquired before class in a practical way and at their own pace, which we expect will promote their interest and motivation as well as their ability to learn self-sufficiency. Therefore the innovation should address the challenges of a competency-based education model (e.g. Salas 2010), which produces creative and innovative professionals. It should also allow teachers more time to provide individual attention to students, answer their questions, and thus meet the learning goals of the course despite the large size of the class.

2. Methods

The project was designed in 2015 and a pilot was implemented the first semester of 2016 (January to June), after which adjustments were made according to feedback from both students and professors. The results presented here correspond to the implementation phase during the second semester of 2016 (July to December).

2.1. Tools applied to the course

We used SICUA+ Blackboard[®] to deliver all the necessary materials to prepare classes, formulate hypotheses or create a previous cognitive imbalance. The pre-class activities included short videos, maps, or texts along with questions that the students had to answer before the class. The virtual platform was also used to upload lectures and other materials so they were readily available to students.

Self-assessment was done with Socrative (<https://socrative.com/>). This is an online app by MasteryConnect which is free and accessible to students. Teachers are able to create a free account and upload quizzes and implement them in various ways, including teacher-paced, instantaneous feedback, or races between students. After the quiz a detailed report is provided, including statistical data on student performance.

2.2. Evaluation of the innovation

The usefulness of both the technological tools and the class activities in students learning and motivation was assessed in two ways. First, the whole class was asked to complete an online survey with general questions about the course as well as a specific evaluation of each class module, including the tools, materials, and types of activity implemented and their usefulness to them for their learning process. Students were requested to fill out the online survey after M1 and their answers were used to improve next two modules. The same online survey was done at the end of M3. The general online survey was completed by 107 students out of 150 that took classes using the new methodology.

Additionally a subset of 25 students were asked to attend a focus group where some of the answers were examined in more detail and students were given the freedom to suggest changes to the overall methodology and to specific activities. Focus groups were done after M1 and M2+M3 immediately after online survey completion in order to assess the different phases of the project.

3. Results and discussion

3.1. Relevance of pre-class activities for the learning process

Pre-Class activities loaded into the online platform were perceived by the students to be key for their learning process (Fig. 1). In M1 (module on plate tectonics), pre-class activities were rated to be very relevant to their learning process by 85.9% of the students; and as the course progressed and students grew more used to the methodology, that percentage went up to 91% in M2 and M3 (Fig. 1). Very few students disagreed on the usefulness of the pre-class activities and during the focus group discussions, those students who did disagree were mainly identified to be those not attending classes regularly and thus not able to apply the concepts in the activities during class.

Our results are in agreement with previous studies presenting flipped class strategies as a better way of learning (e.g. Berrett 2012; Garza 2016; Wallace et al. 2014). Clearly the students benefit from the application of previously acquired concepts to activities where those concepts are put into a practical frame.

We noticed a great improvement in student preparation of classes compared to groups not using the flipped class strategy. The fact that they knew the basic concepts before coming to the class improved their motivation to do the activities (based on focus group results) and therefore their understanding of key concepts. But additionally it improved their learning process, as shown by a significant improvement in their test results compared to sections not using the new methodology (results not shown).

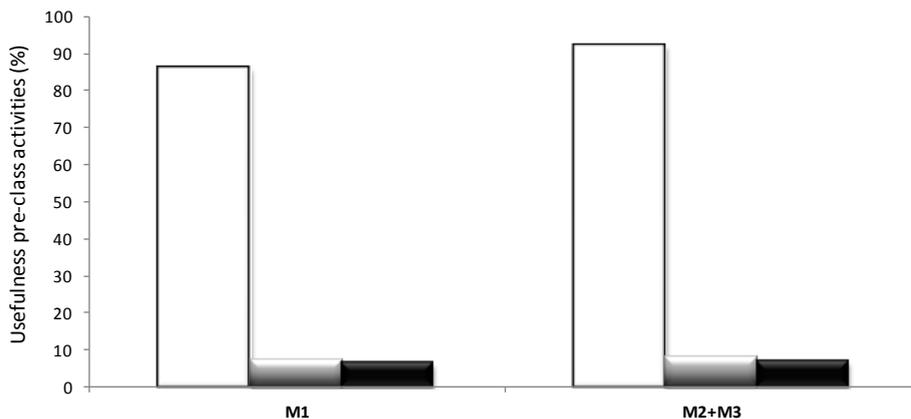


Figure 1. Relevance of pre-class activities for students' learning process. Results were separated into Module 1 (M1) and Modules 2 and 3 (M2+M3). Categories indicate "In agreement" (white), "Neither agree nor disagree" (grey); and "Disagree" (black).

3.2. Usefulness of technological tools for material comprehension

The use of TICs has been shown to greatly improve the comprehension of basic and complex concepts necessary to the learning of a subject (e.g. Badia 2006; González-Coma et al. 2015). However, our students found some of the TICs more useful than others, and additionally, their usefulness was rated differently depending on the module in which they were applied (Fig. 2).

The Sicua⁺ virtual platform was rated as being useful for learning by 88% of the students in module 1 but only 66% in modules 2 and 3. Despite asking in the focus group, we could not determine the factor that lowered the rating of SICUA+, other than that some students felt overwhelmed by the amount of content in the virtual platform. A better organization of the content may help improve the perception of the students in the following semesters.

In contrast, Socrative was found useful by 68% of the students in M1, and this went up to 77% in M2 and M3 (Fig. 2). The lower percentage in M1 was tracked to the lack of feedback on the quiz results in that module due to time constraints. The focus group after M1 suggested that more time should be spent on revising answers and explaining results. This was therefore implemented in the following modules, and likely explains the great improvement in the survey results in M2 and M3. From this, it is clear that student feedback is essential to the satisfactory development of a course and should always be solicited at several points during the semester rather than only at the end of a course.

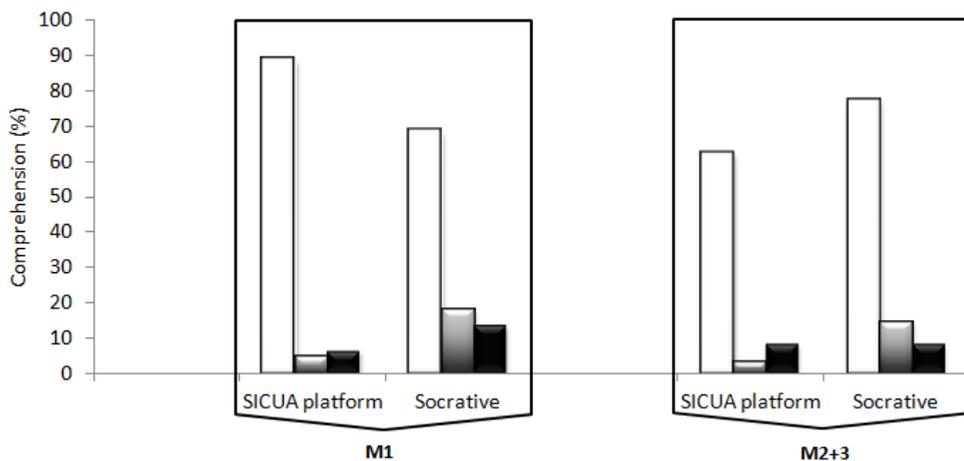


Figure 2. Usefulness of different tools for material comprehension. Results were separated into Module 1 (M1) and Modules 2 and 3 (M2+M3). Categories indicate "In agreement" (white), "Neither agree nor disagree" (grey); and "Disagree" (black).

3.3. Importance of Socrative to Aid Interactions

In the previous section, we discussed the importance of providing students with immediate in-class feedback and discussion of the results of their Socrative quizzes, in order for the auto-evaluation process to be effective. Here, we will focus on the significance of the online quiz app in improving interactions between students and with the teacher.

Greater interaction both among students, and between students and teacher improves the learning process through i) peer teaching between students and ii) individual teacher attention for students in big class groups.

Our results show an improvement in interactions both between the classmates and between classmates and teachers in M2 and M3 (Fig. 3).

It seems that increasing the amount of time spent in discussing answers during the class made the students feel more engaged and they increased the amount of interaction (discussion) amongst themselves in order to reach an agreement about the "right" answer to each question or problem. Providing on-the-spot feedback in class was also perceived to improve student-teacher interactions.

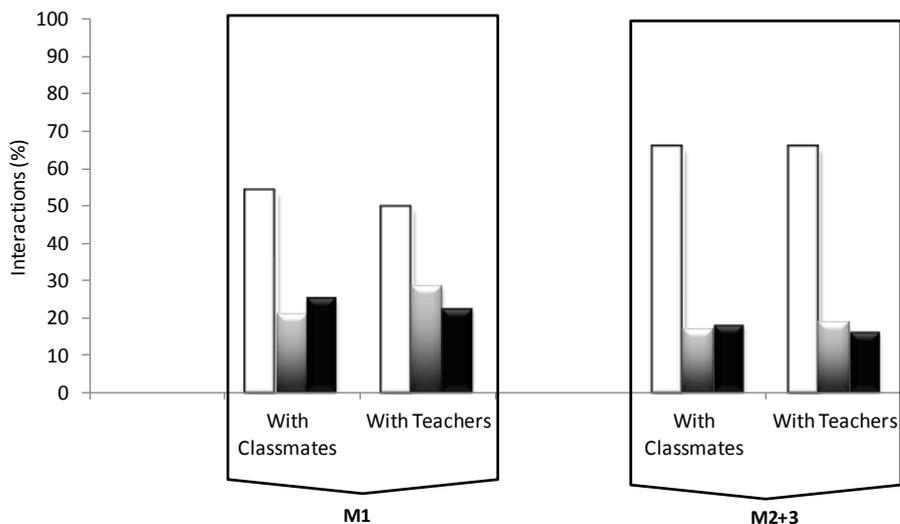


Figure 3. How did Socratic help interactions? Results are separated into Module 1 (M1) and Modules 2 and 3 (M2+M3). Categories indicate "In agreement" (white), "Neither agree nor disagree" (grey); and "Disagree" (black).

Additionally, while all socratic quizzes were done individually in M1, during the later modules students were allowed to do some quizzes in groups which clearly had a positive effect on student-student interactions, and increased the amount of discussion and peer teaching. Students also reported that class activities helped them work in groups and that in some cases they used the same groups to study for the exams.

4. Conclusions

- 1) The technological tools used in the innovation presented here succeeded in improving student motivation and engagement with their learning process, according to online surveys and focus groups.
- 2) A development of transversal skills such as team work or ability to solve problems independently was also observed in the students, compared to other sections of the course that did not implement the innovations.
- 3) Student feedback is essential for the adequate development of the course and as such should be sought at several points during the delivery of the course, rather than only at the end of the semester.

4) Additionally, although the data are not shown here, we found that students achieved better results overall, including a 50% decrease in student failure rate and less than a 5% dropout rate.

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Boosting the Employability of Students and Staff at European Higher Education Institutions: An Educational Framework for Entrepreneurship, Internationalisation and Innovation

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Abstract

Globalisation has altered the conditions of work and learning in Europe. Many European countries specialise in non-offshorable, knowledge- and skill-intensive tasks which require a highly educated workforce that is able to interact in global settings. European Higher Education Institutions (HEI) face the challenge of meeting the increased demand for skills of globalised work environments. In order to do this, HEI need to adapt their educational concepts. This involves promoting internationalisation, entrepreneurial and innovation skills. This paper aims to develop an educational framework for boosting student and staff employability at European HEI. It further adds to the practical dimension of HEI internationalisation, entrepreneurship education and innovation pedagogy by presenting an example how these interrelated concepts can be integrated into the curricula of HEI. At the methodological level this implies broadening traditional content-focused curricula and making use of active teaching methods that foster deep learning, best acquired in real work situations. Taking internationalisation serious further entails building up virtual learning networks and tapping the full potential of e-learning.

Keywords: *employability, Higher Education Institutions, entrepreneurship education, innovation pedagogy, internationalization, globalisation*

1. Introduction

Globalisation has altered the conditions of work and learning. As a result of the increasing integration of production across borders many European companies specialise in non-offshorable, knowledge- and skill-intensive business models to foster economic growth. The current labour market expects graduates and staff of Higher Education Institutions (HEI) to be equipped with the ability to interact in global settings as well as with specific international, intercultural, innovation, and entrepreneurship skills. This poses a challenge to the educational concepts of HEI which are expected to promote the employability of students and staff. Employability refers to a “set of skills, knowledge, understanding and personal attributes that make a person more likely to choose and secure occupations in which they can be satisfied and successful” (Dacre Pool & Sewell, 2007, p.280). These attributes go beyond ‘simply’ holding a degree. This paper asks: How can HEI respond to the growing demand for entrepreneurship, innovation, and international skills induced by increasingly global work environments?

The aim of this paper is to develop an educational framework for boosting student and staff employability of HEI in Europe that addresses the needs of increasingly globalised, flexible, and uncertain work environments. It further seeks to add to the practical dimension of internationalisation, entrepreneurship education, and innovation pedagogy by presenting an example how these interrelated concepts can be integrated into the curricula of HEI.

The authors argue that boosting student and staff employability requires adapting the educational concepts of HEI. Internationalisation, entrepreneurial and innovation skills help HEI students and staff to excel in highly uncertain environments. This implies broadening traditional content-focused curricula and making use of teaching methods that foster deep learning (Bennet & Bennet, 2008), best acquired through active methods and learning in real work situations. Incorporating internationalisation (Hénard, Diamond, & Roseveare, 2012; Wit, Hunter, Howard, & Egron-Polak, 2015), entrepreneurship education (e.g. Henry, Hill, & Leitch, 2005a, Neck & Greene, 2011) and innovation pedagogy (Kettunen, 2011; Kettunen, Kairisto-Mertanen, & Penttilä, 2013) into HEI curricula is an important step towards establishing entrepreneurial universities (OECD & EC, 2012).

This paper is structured as follows: The literature review in part two briefly introduces the concepts of entrepreneurial universities, internationalisation of HEI, entrepreneurship education and innovation pedagogy. It closes with an overview of the sets of skills these concepts aim to promote and the tools/methods that are most suitable to impart the latter. Part three proposes an educational framework for boosting student and staff employability at HEI. Part four gives an example for how this framework can be implemented at HEI using the example of the Erasmus+ Project “INTENSE – INTernational Entrepreneurship Skills Europe”. The paper concludes by mapping out avenues for future research.

2. Literature Review

The concept of entrepreneurial universities emerged as a response to the changes within higher education triggered by globalisation. New technologies, an emerging knowledge economy and new funding conditions, inter alia, pose new demands on HEI in Europe and call for a redefinition of the purpose, the societal and economic role, and the structure of HEI. Entrepreneurial universities seek to foster entrepreneurship development in teaching and learning, university-business/external relationships for knowledge exchange, and internationalisation (OECD & European Commission, 2012). These objectives are closely linked to the educational concepts of internationalisation, entrepreneurship education, and innovation pedagogy. The three concepts all seek to increase the employability of students and staff at HEI while focusing on different sets of skills and methods (s. table 1).

2.1 Internationalisation of HEI

The internationalisation of HEI is understood as “a commitment, confirmed through action, to infuse international and comparative perspectives throughout the teaching, research and service missions of higher education.” (Hudzik, 2011, p. 6) It has become an umbrella term whose implementation covers two dimensions: Internationalisation at home refers to enhancing international and intercultural skills of students at the domestic level by incorporating international and intercultural dimensions into curricula as well as teaching, research and extracurricular activities. Internationalisation abroad comprises educational activities across borders, such as distance learning, student and staff mobility, credit and degree mobility, establishing networks among students, scholars and institutions and off-shore campuses (Altbach & Knight, 2007; Wit et al., 2015). An important component of internationalisation is its virtual dimension, i.e. the use of information and communications technology (ICT) in education, offering students worldwide more and cheaper educational opportunities irrespective of their residence (Hénard et al., 2012).

2.2 Entrepreneurship Education

The vast strand of literature on entrepreneurship education (Valerio et al., 2014) has revealed two important findings: First, there is no overarching theory of entrepreneurship, hence, the skills attached to entrepreneurship remain contested. Secondly, the objectives, contents, and teaching approaches of entrepreneurship programmes at HEI vary greatly (Kratzer, Haase, & Steiner, 2013). Entrepreneurship Education ranges from imparting entrepreneurial characteristics, raising awareness and teaching the process of setting-up and running a business to specific training for entrepreneurs, e.g. marketing or product

development (Henry et al., 2005a). Although there is no common understanding of entrepreneurial skills, entrepreneurship education scholars seem to agree that entrepreneurship comprises task-oriented skills, e.g. for small business development and management, as well as behaviour-oriented skills, such as problem-solving, innovation, risk-taking and persistence (Henry et al., 2005a). There also seems to be agreement that at least some aspects of entrepreneurship (e.g. business management, technical management, marketing, etc.) can be taught at HEI (Henry et al., 2005b). Neck and Greene (2011, p. 57) argue that teaching entrepreneurship should be understood in terms of teaching a method (as opposed to a process with known inputs and outputs). Entrepreneurship as a method enables students to develop opportunities and implement activities in uncertain environments (Neck & Greene, 2011).

2.3 Innovation Pedagogy

Innovation pedagogy was developed in Finland as a means to boost the employability of students, promote applied research, and to support regional development. It is rooted in constructivism and social learning theories which emphasise the learning effects of group interaction (Kettunen et al., 2013). Innovation pedagogy comprises five elements: 1) multi-field interactions of different parties and organisational entities within inter-university network projects; 2) applied research that makes use of regional knowledge and networks; 3) flexible curricula to enable entrepreneurial and international activities; 4) entrepreneurship; and 5) internationalisation (Kettunen, 2011). Hence, innovation pedagogy provides a more holistic educational framework that includes entrepreneurship and internationalisation, however, it lacks a detailed approach to how the latter can be integrated into HEI curricula. The desired learning outcomes of innovation pedagogy encompass both, ‘hard’ knowledge related to the respective study-programmes and innovation competencies needed for innovation creating processes at the work place, understood as “a cluster of separate, at times overlapping, competences, capacities and skills, which all together can be regarded as innovation competence” (Watts, García-Carbonell, & Andreu-Andrés, 2013, p. 4).

Table 1. Relevant Sets of Skills for Internationalisation, Entrepreneurship and Innovation

	Internationalisation	Entrepreneurship	Innovation
Set of skills	<ul style="list-style-type: none"> • Intercultural skills • Foreign language skills • Global awareness • Ability to interact in global settings 	<ul style="list-style-type: none"> • Task-oriented skills: small business development and management • Behaviour-oriented skills: personal traits 	<ul style="list-style-type: none"> • Set of individual, inter-personal and networking skills needed in innovation creating processes
Tools/Methods	<ul style="list-style-type: none"> • Intercultural trainings • distance learning • Student/staff mobilities • Credit/degree mobility • International networks • Off-shore campuses 	<ul style="list-style-type: none"> • Entrepreneurship as a method • Active: learning by doing • Practicing skills in real life/work situations 	<ul style="list-style-type: none"> • Creating intra-HEI & regional networks • Applied research • Group interactions • Entrepreneurial and international activities

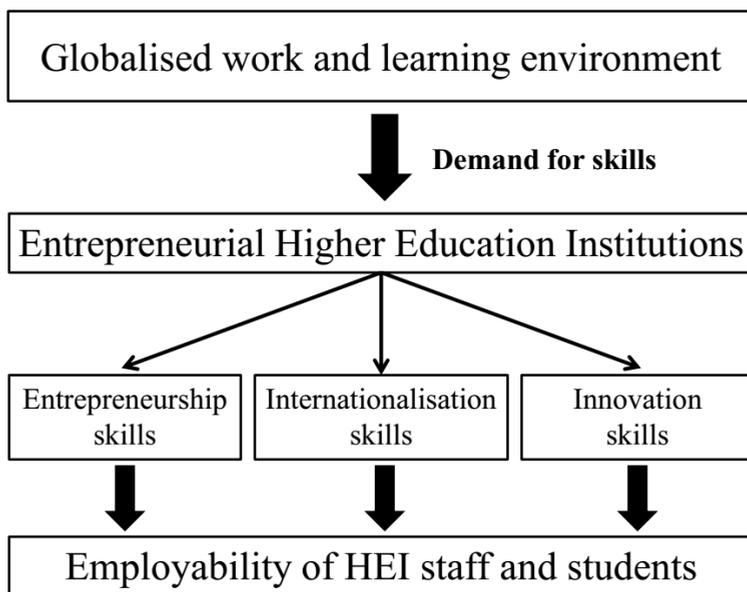
Source: the authors

3. Educational Framework

While all of the three educational concepts discussed above aim to increase the employability of students – although their tools and methods remain generally vague – their individual scope and outreach are too narrow to meet the demands of globalised work environments. On the one hand, HEI need holistic educational concepts that equally impart internationalisation, entrepreneurship and innovation skills. On the other hand, this paper argues that it is crucial that educational concepts target students *and* staff of European Higher Education Institutions, e.g. through international staff trainings, (long-term) staff exchanges and collaborations with local and international external partners (European Commission, 2006).

The educational framework proposed in chart 1 illustrates the relationship between globalisation, the skills of HEI students and staff, and employability. Globalisation has changed work and learning environments. Globalised work environments in turn require specific sets of skills that go beyond content-related expertise in a specific field of study. In order to meet the growing demand for skills of globalised work environments, HEI need to become more entrepreneurial. This entails adopting an educational concept that promotes internationalisation, entrepreneurship and innovation skills of students and staff alike, thereby enhancing their employability.

Chart 1. Education Framework: Boosting the Employability of HEI Students and Staff



Source: the authors

4. The Example of “INTENSE”

Incorporating the different elements of this framework into the rigid curricula of HEI is a challenging task that requires financial and personnel resources and some creativity. The international project “INTENSE – INTERNATIONAL Entrepreneurship Skills Europe” is currently being implemented across Europe¹. The aim of INTENSE is to develop and implement a transnational teaching module on the internationalisation of small and medium-sized enterprises (SMEs) as an Open Educational Resource (OER). It involves establishing collaborations between HEI, HEI staff and students, SMEs, policy-makers and regional business associations. All participating HEI integrate the teaching module into their curricula.

INTENSE hereby follows the approach of innovation pedagogy, incorporating entrepreneurship education and internationalisation of HEI. 1) The project is designed multi-field, including HEIs with different core competences (entrepreneurship, project management, business, logistics), and regional networks by building national stakeholder

¹ Project lead: University of Applied Sciences (HTW) Berlin, GE. Project partners: Hoogeschool Utrecht, NL; University Colleges (UC) Leuven-Limburg, BE; University of Applied Sciences Turku, FI; J.J. Strossmayer University of Osijek, HR. Financed with the support of EU under Erasmus+.

committees, including business associations and chambers. 2) It spurs applied research in the form of intellectual outputs, such as publications on learning results, an internationalisation toolkit for SMEs, a tool for assessing innovation skills, and policy recommendations. 3) INTENSE develops a module on “internationalisation of SMEs”. This module is composed of different units which can be taught independently in order to ensure flexible curricula tailored to students’ needs. 4) The module follows entrepreneurship education approaches by developing task oriented skills (business models of SMEs and internationalisation processes) and behaviour oriented skills (project management and consultancy skills). It further provides an opportunity for HEI learners to implement their knowledge in real work situations as they consult SMEs in their internationalisation process. 5) Finally, INTENSE supports the internationalisation of HEI at home by including internationalisation and intercultural aspects into curricula and abroad by establishing a transnational, virtual learning platform, collaborative e-learning tasks in international groups, trainings for students and staff, including a long-term staff exchange, and student and staff mobilities in the form of regular joint summer schools. The innovation competencies of HEI staff and students are measured before and after the project using the INCODE barometer.

The project increases the employability of students and staff as they gain deeper knowledge of entrepreneurship issues, international and intercultural experience, enhanced digital skills and an increased international professional network. HEI increase their international competitiveness and broaden their regional and international network.

5. Conclusion

Incorporating the educational concept of innovation pedagogy with a stronger focus on entrepreneurship education and internationalisation into the curricula of HEI is an important step towards becoming more entrepreneurial. The educational framework proposed in this paper contributes to the debate on how HEI can respond to the growing demand for skills induced by globalisation, in general, and on enhancing the employability of HEI students and staff, in particular. The INTENSE project served as an example for how this framework can be filled with life, however, this paper is limited to a theoretical framework and further research to empirically support its impact on employability is needed.

The methodological implications of integrating entrepreneurship education, innovation pedagogy and internationalisation into curricula at HEI provide an important avenue for future research. There is agreement in the literature that the skills related to these concepts have a strong ‘arts’ dimension that goes beyond teaching ‘science’, i.e. specific hard facts, through conventional pedagogical methods (Henry et al., 2005b). Understanding innovation, internationalisation and entrepreneurship as an art implies making use of active, learning-by-doing methods which relocate learning processes from the classroom to real

work environments. What is more, taking internationalisation serious entails building up virtual learning networks and tapping the full potential of e-learning.

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The First Step to Becoming a Kindergarten Teacher: Difficulties and Challenges

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Abstract

After finalising formal training, the first year in the field of teaching is a year of great expectations and anticipation on the side of the novice teachers, as well as experiencing nervousness and lack of confidence. The literature addresses this subject from the aspect of teachers in school, where it has been found that this first year represents a period of challenges, dilemmas and difficulties. Little though has been written from the aspect of kindergarten teachers. The authors assume that novice kindergarten teachers face similar experiences. During this first year, it is obligatory for the novice kindergarten teachers to attend a professional development workshop. The aim of the workshop is to provide a significant support system for the novice teacher in this challenging year.

The aim of this research was to examine the novice kindergarten's dilemmas and challenges during this critical first year and their attitudes towards the professional development workshop concerning the relevance of the workshop in assisting the kindergarten teachers in dealing and coping with the dilemmas that arose from the field.

The findings indicate that the novice kindergarten teachers experience similar dilemmas in their first year in the field as do teachers. It was also found that the workshop was not a significant factor in helping the novice kindergarten teachers cope with this challenging experience. This leads to the conclusion that it is necessary to re-evaluate this framework in order to make it a place of significance for the novice kindergarten teachers.

Keywords: *Novice kindergarten teachers: Professional Development workshop:*

1. Introduction

The induction of new teachers into the field represents a period of great expectations, for the student teachers of themselves and of their future employees. The students expect to be significant to their pupils and to their future work place. In reality, the transition from student teacher to new teacher, or in-service teacher, is a period fraught with tension, anxiety and learning through trial and error. First year teachers are expected to “hit the ground running”. In fact, the statistics show that 10% of them will not return after their first year, with the number increasing to almost half in the first five years (Kaiser, 2011). There is limited research that investigates this process in the sector of kindergarten teachers (Oplatka, I& Eisenberg, M. 2006). The assumption of the writers being that the induction process and the professional development of kindergarten teachers are similar to that of primary and high school teachers.

This article will be investigating the process of training, especially the obligatory workshop, that is part of the professional development of kindergarten teachers in Israel in their first year of working as kindergarten teachers in Israel.

2. Kindergarten Teachers’ Training in Israel

In Israel, a kindergarten teacher will train in a teachers’ training college or university for four years and receive at the end of this time, a first degree with a licence to teach. During the four years, her training includes theoretical studies and practical experience. At the end of the four years she is expected to sign on for additional courses that are organised by the ministry of education. Every year, each kindergarten teacher has to complete 60 hours of courses that will expand her professional knowledge.

<http://edu.gov.il/owlheb/Pages/default.aspx>

During the period of training in college, the students acquire theoretical and practical knowledge through their practicum. The period of practice is often described as being the most significant for the student in the building up of their professional identity (Dan, 2012). The aim of the practical experience is to prepare them for their induction period.

3. Model of Kindergarten Teachers Training In Israel

98 Hours of Accreditation –Practical and Theoretical Knowledge

The following figure illustrates the division between theoretical studies and practicum in the training program for (or kindergarden?) kindergarten teachers who train for their profession in a teacher training college.

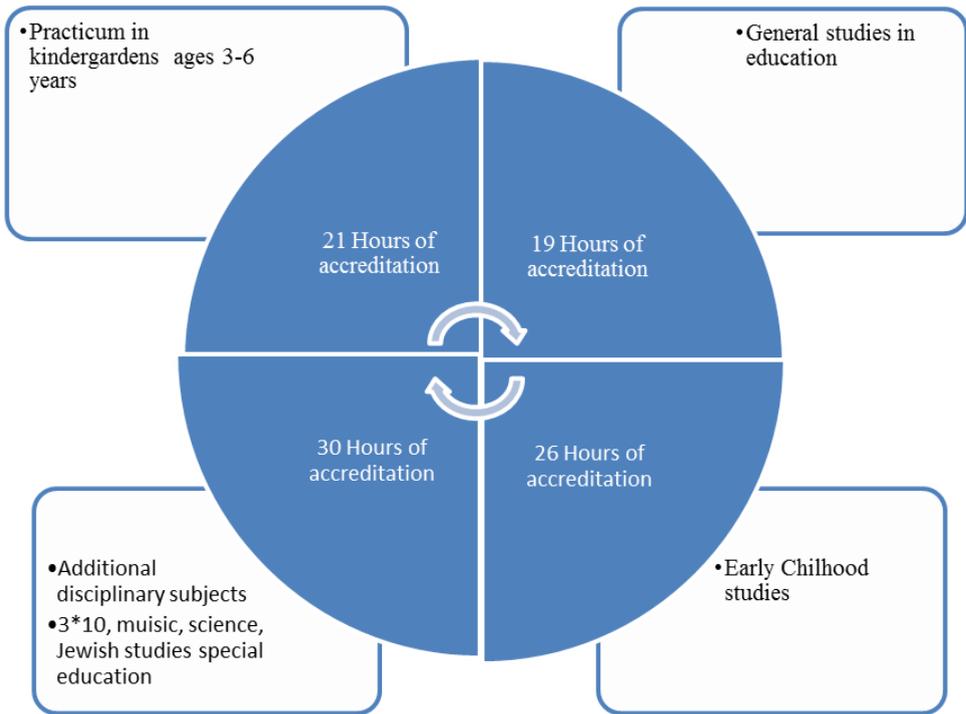


Figure :1 Division between theoretical studies and practicum in Kindergarten teacher's training program.

Figure 1. Shows division between theoretical studies and practicum in Kindergarten teacher's training program

The stage of induction, the entrance into the profession, consists of a year of “internment” followed by two years in the field after the initial first year. This period of time often constitutes a time of great difficulties as well as a lack of self-confidence or self-efficacy (Dan, 2012). The experiences that the novice kindergarten teacher encounters in the first year effect her motivation for wanting to continue in this profession. A successful period of induction will positively affect the new kindergarten teacher's professional identity and aid in lowering the future attrition of kindergarten teachers.

The role of kindergarten teachers is complex, demanding knowledge in child development, management, disciplinary subjects, first aid, pedagogical knowledge of each stage in a child's development, knowledge in the building of a curriculum, knowledge in identifying children with special needs and how to enter into a significant dialogue with parents. In addition, the hours are long and there are no additional professional adult staff with whom the kindergarten teacher can consult in the process of decision making during the day's activities. The kindergarten auxiliary staff do not have the same professional training as the

kindergarten teacher and very often have held their position for a number of years before the novice kindergarten teacher starts her induction period. The quality of the team work between the kindergarten teacher and her staff can play a major role in the feelings of professional competency for the novice kindergarten teacher (Oplatka, I& Eisenberg, M. 2006). In time, if the kindergarten teacher remains in the profession, she attains a level of confidence coupled with maturity that comes with increased experience and thus her professional work reaches a higher level. In addition and unique to this system, a kindergarten teacher is considered the “kindergarten manager” from her first year. In most professions, one achieves the level of management after years of experience, after one's work is recognized and appreciated by one's superiors.

Kindergarten teachers are expected to act as educational leaders and experts on preschool education. Their main objectives include the management of the kindergarten staff, implementing change, possessing innovation, organizing the day-to-day pedagogical activities and encouraging children's play, all within a positive atmosphere.

<http://edu.gov.il/minhalpedagogy/preschool/Pages/preschool-education.aspx>.

4. Difficulties of New Teachers

Before actually practicing teaching, the impressions one has of teaching are based on previous subjective experiences of what it is to be a teacher and very often there is a "reality shock" (Weinstein, 1988). According to the literature, the experiences of the new teacher in her first year of teaching determine the concepts and beliefs of what it means to be a teacher, what teaching is, who the pupils are and what the school environment comprises (Gold, 1996; Gratch, 1998). In addition, a link has been found between the early experiences of new teachers and their ability to continue as teachers and to develop in their profession (Chapman & Green, 1986). The development of the teacher includes three stages:

Preservice - as a student teacher.

Induction - the first years of teaching.

In-service - experienced teacher.

The induction stage has been described as being the most difficult of all stages. The difficulties that were indicated by the new teachers included:

Class discipline, motivation of the pupils, different needs of the pupils, relationships with parents, evaluation of the pupils, stress and a large number of tasks to be completed, the knowledge needed to teach disciplinary subjects..... and many others (Veenman, 1984). According to Heath-Camp and Camp (1990), the difficulties addressed three areas, the school policies, the students (behaviour) and internal struggles (self-

confidence, time management and organizational skills). The ability to survive depends on the support systems or the barriers that are erected during these first years.

To become a teacher or a kindergarten teacher involves a process that requires the tenacity and understanding that the process is complex and can take years. To become a kindergarten teacher, who is proficient and confident in her work, demands challenging previous belief systems and realising that the first few years are also part of one's initial training.

The significance of this research is to address the training that student teachers undergo, specifically the professional workshop that is obligatory in the first year in the field after the completion of their professional training in college.

5. Methodology

The research was conducted in a teacher training college in the north of Israel. The research population consisted of 38 female students who are in their fourth year of training for their teacher's license and participate once a week in a professional workshop under the auspices of the college as part of the accreditation process.

The research was a pilot research designed to examine the effectiveness of the workshop in providing a significant framework for the novice students at the critical stage of their training,

The students were requested to fill in a questionnaire at the beginning of their session, three months after the beginning of the school year. The questionnaire consisted of general questions that related to the kindergarten, for example, the number of children in the kindergarten, the type of kindergarten, secular or religious. The questionnaire also consisted of questions that related to the effectiveness of the workshop as a significant framework for addressing their needs in this critical year in their professional development.

6. Findings

The initial results indicated as follows:

- 1.The students indicated that the workshop did not fully address their needs which arose from difficulties and challenges from their experiences in the field.
- 2.The greater the difficulties the student encountered in the field, the less effective the assistance they received from the workshop.

3. The most significant difficulties that were indicated were in the areas of management of the kindergarten and teaching diverse groups of children.

Most of the students indicated that they see the profession of teaching as a "mission" and expressed a high level of motivation to succeed in their chosen profession. A small number indicated that they consider leaving the profession.

The students reported a high level of self-ability and consider teaching to be a high status profession equal to medicine or psychology.

7. Conclusions

The first year in the professional life of a kindergarten teacher is challenging and beset with dilemmas. To enable the novice kindergarten teachers to succeed at this critical stage, it is essential that they receive an effective support system. As a consequence of this research, it is essential that the workshop framework that has been provided for this purpose undergoes reevaluation in its effectiveness in fulfilling the novice kindergarten teachers' emotional and professional needs.

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The dialogical approach: education for critical consciousness

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Abstract

In this paper I will try to present an alternative approach to teacher-training that is based on the Freirian dialogic approach. The goal of this approach is to raise the students' awareness of the reality in which they live and to provide them with tools for critical analysis of that reality. Instruction that is based on respect for the students and on belief in the capacities and knowledge that they bring with them is instruction that combines the students' personal experiences with the study of existing theory in the field. The combination of personal experience and theory leads to the production of new knowledge. In this paper I describe my personal experience as a lecturer in the Oranim Academic College of Education in Israel. The description includes an explanation of the courses, the manner of instruction, the topics addressed, the main issues that come up as the students bring their experiences to the classroom, the students' response to the courses and my own perspective of this experience: what can be learned from it and how it can be applied.

Keywords: Dialogue, Critical Education, Teacher- training, Students

1. Introduction

For the past five years I have been trying to develop a dialogic teaching approach in the Oranim College. I had been captivated by this approach ever since I first came across the writings of Paulo Freire. I applied the dialogic approach for many years while conducting Jewish-Arab dialogue work in Wahat al-Salam / Neve Shalom. There we conducted Jewish-Arab dialogue in small groups and in this forum it was relatively easy to apply Freire's dialogic principles. However in a conventional classroom where the students are accustomed to frontal teaching and where they regard the lecturer as the sole source of knowledge, applying the dialogic approach is a much greater challenge. At first I encountered difficulties from students who seemed suspicious of the approach as well as difficulties stemming from my own lack of confidence in this innovative method. As time went on the work flowed more easily and succeeded well beyond my expectations.

In this paper I would like to share with the readers my experience as a "dialogic lecturer," addressing both the successes as well as the obstacles that I met along the way. I begin with a brief presentation of the dialogic approach as it appears in Freire's writing and afterwards I will describe the structure and process of a dialogic lesson. I will describe the difficulties that I encountered in conducting these lessons and finally I will present the students' attitudes towards these lessons as expressed in lesson summaries and in the feedback that they gave in the framework of the college's evaluation.

2. Freirian Dialogue

Paulo Freire, one of the founders of critical pedagogy, claimed that humanization has been the central challenge throughout our history:

While both humanization and dehumanization are real alternatives, only the first is the people's vocation. This vocation is constantly negated, yet it is affirmed by the very negation. It is thwarted by injustice, exploitation, oppression, and the violence of oppressors, it is affirmed by the yearning of the oppressed for freedom and justice, and by their struggle to recover their lost humanity. (Freire and Macedo, 2000, P 45).

Freire (1982) goes on to claim that the education system is usually an oppressive system acting to preserve the status quo and serve the ruling elite. Schooling, Freire writes, is based on a "banking" concept in which the teacher "deposits" knowledge into the students' "accounts" in order to "withdraw" that knowledge at a later time. The underlying and actual purpose of the banking concept is to maintain a social structure that is based on

oppressors and oppressed. By undermining the students' critical and creative capacities, banking education serves the interests of the hegemonic group that benefits from the existing social order.

In order to liberate the student, a dialogic pedagogy must be implemented in the schools with the goal of raising the students' awareness of their situation. They must be enabled to reach an awareness of the oppressive reality in which they live, of the reasons for their oppression and of the options for liberation. Only through consciousness, says Freire, can a person act in the world in order to change it. Only through "praxis," the combination of consciousness and action towards change, can a people achieve their vocation of humanization (1970).

The dialogue according to Freire (1992) is not a mechanical discussion conducted by taking turns in the classroom, nor is it a psychological discourse aimed at making the students feel good without changing the reality. The dialogue is interaction between the teacher and her students through which everyone takes part in creating new knowledge. The dialogue begins with the participants' personal experience and, through the educational process, leads them to apply theory that enables them to gain insight into broader social processes. Discussion of personal experience alone is not sufficient, however the students' personal experience must not be skipped over with discussion going directly to the level of theory and generalization. The dialogue is a process undertaken jointly in order to recognize, challenge and even change the reality.

Freire (2000) writes that the teacher cannot be passive in her educational work. She must be active, giving direction and presenting a path, but she must not demand of her students to take it. According to Freire the teacher cannot be objective or neutral, therefore she has two options. She can either avoid taking a stand and by doing so take part in the oppressive work of the establishment or she can express her opinion in order to expose the reality of oppression and challenge it. In the latter case the teacher must still be careful not to force her opinions on the students.

Not much on this topic appears in the literature, particularly regarding the application of a dialogic approach in an academic setting. Even less has been written about the application of the dialogic approach as expounded by Freire. The literature that does exist confirms the effectiveness of every aspect of the approach in every framework in which it is applied. Mercer & Littleton (2007) primarily addressed theoretical aspects of dialogue and its effectiveness in classroom instruction. They cite a great deal of research proving the connection between dialogic instruction, the students' learning capacities and particularly the development of the students' thinking skills. Vella (1994) discussed the power of applying a dialogic approach in adult education, particularly in that the learner also teaches. She defines twelve principles of dialogue and demonstrates how the application of these

principles in adult education ensures effective learning. Wallerstein & Bernstein (1988) discussed the application of Freire's dialogic approach as an effective means of healing. They claim that participation in a dialogue group improves the participants' self-control and strengthens their belief in their ability to change their lives. They demonstrate this through a case study of an alcoholics' rehabilitation group. As mentioned above, in this article I will discuss the application of Freire's dialogic approach in the framework of an academic classroom.

3. Dialogue experience in the classroom

My past five years of teaching in Oranim's Academic College of Education have been guided by an attempt to apply Freire's dialogic approach presented above. I apply the approach in M.A. teacher training courses as well as in an M.A. program on inclusive education. There are usually about 20 students in a class, representing very different backgrounds. There are both Ashkenazi and Mizrahi Jewish students and sometimes there are Ethiopian Jews. There are also Arab students.

The course is divided into two parts. The first part usually consists of four lessons devoted to learning about the approach. The students not only learn the approach by reading Freire's work on the pedagogy of the oppressed and on dialogic learning; they also learn about it through the example I set, demonstrating the approach in the way that these lessons are conducted. In the second part of the course the students are given the opportunity to apply the approach. Ten students are invited to conduct a lesson putting the dialogic approach into action.

The lessons conducted by the students are divided into two parts. In the first part each student teaches a 45-minute lesson as is given in the high school. In the second part we analyze the lesson, examining the extent to which it was in fact conducted through Freire's dialogic approach and where the student's difficulties lay in applying the approach. The student-teacher himself is given the opportunity to open the analytical part of the discussion, sharing his experience with the class and evaluating his own work. This is followed by contributions from the other students and from me as we work together to evaluate the lesson with the aim of learning from each one's successes and difficulties.

It must be noted that the students have the right to choose the topic that they wish to teach. Most of the students choose socio-political or educational topics that concern them. Among the topics chosen over the years were: discrimination against Mizrahi Jews, the status of women, the Arab education system, the social reality of peripheral as opposed to central regions of the country, the Druze in Israel, excluded students, racism in Israeli society, the implications of teachers' approaches and attitudes for the fate of their students,

multicultural education etc. Each topic is introduced by presenting something that evokes a response such as a short film, a newspaper article or anything else that the student chooses in order to start the lesson.

As mentioned above, the students learn about the approach through their own practice and experience and through that of their peers. By working together through the dialogic approach the students also gain new insight and expand the knowledge in a variety of fields. This knowledge is usually produced in the students' presentations, but it also stems from the dialogue through which students share their personal experiences with each topic.

I can point out a number of issues from my experience that commonly arise in these lessons. The first one is the student teachers' difficulty of dealing with silence – even a short silence of a few seconds. The student-teachers tend to fill each moment of silence with their own speech, blocking the other students' opportunities to take part in the lesson and express their opinions. In analyzing the lessons the student- teachers speak of the difficulty of remaining silent. They are not accustomed to silence in the classroom and they express concern that the other students may interpret their silence as an indication that they have nothing to say and as a sign of weakness. On the other hand the students in the class often say that had the student-teacher waited a bit more, they would have had time to organize their thoughts and contribute to the discussion.

The second issue is the student-teacher's difficulty of addressing points that the students try to stress when they share their experiences. The student-teacher at first finds it difficult to relinquish control over the agenda and allow true dialogue to take place. While ostensibly inviting dialogue, they actually find it difficult to free themselves from a frontal approach through which they attempt to steer the students towards the particular discussion that they, the student-teachers, wish to conduct. In other words they force their agenda on the students creating a frontal lesson that is merely disguised as dialogic.

The last issue has to do with the student-teacher expressing an opinion. Most of the students who conduct lessons still maintain a belief in the narrative that the teacher must be objective and neutral. The expectation of them to take a stand regarding the topic that they bring is very difficult for many of them. When analyzing the lesson they speak of the trouble they had deciding what they can say, what they cannot say and at what point they should express an opinion and share their own experiences, if at all.

4. Students' Feedback

Over the years the feedback that the students gave both in the summaries of the courses and in the evaluations conducted by the college has been very positive. The students expressed their appreciation of the opportunity that they had to express themselves and they noted the diversity of the material that was introduced into the classroom as a result. Below are a number of quotes from some of the feedback that reflect the students' experience.

One student summarized the course as follows: "This was one of the most interesting courses that I took in all of my university studies. It enabled us to conduct constructive dialogue in a clear and successful manner. We had the opportunity to express ourselves, in contrast to almost all of the other courses that were based strictly on the research literature. This course included everything."

Another student continued in this direction, explaining the uniqueness of the course and how it differs from the others: "The course was very interesting. The way in which the course was taught was very interesting because the lecturer connected the theory to our daily lives. He devoted time to teaching the theory and most of the lesson involved discussion and our own comments. That was almost the first time that I felt that I truly knew what we were talking about in a course, without reviewing the course summaries! I would recommend that this be a mandatory course for all of the students in the college."

One of the positive points that the students repeatedly brought up was the connection between the theory and their reality: "The course was based on a model that I very much connected to. We studied both the theory and its practical application. I feel like I can take the principles that I learned in the course and apply them in my work."

The opportunity that the students had to experience teaching a lesson during the course contributed to their ability to connect theory to practice: "I learned another way to conduct a lesson. The very fact that the students were given an opportunity to conduct a 45-minute lesson to other students in the class gave me the experience of conducting this kind of lesson. Moreover, I learned to deal with different situations that can arise when teaching a lesson like that".

These courses opened the participating Jewish and Arab students to issues regarding relations between the two peoples and regarding the conflict that shapes much of the reality in which they live: "The course was very interesting. It's a course that enables a positive meeting between Arabs and Jews and creates a good space to conduct dialogue about every aspect of the conflict between Arabs and Jews. It exposed us to topics that were so interesting and it exposed me in particular to things that I never knew. It was interesting to see the two sides talking, with everyone presenting his perspectives."

Continuing in that vein another student said: "A unique course like nothing I ever came across in the college. The course enlightened me in the best possible way about the Israeli-Palestinian conflict. It provided a real opportunity to create dialogue between two groups in conflict. I have to point out that I have many friends from both groups and in this course I heard opinions that I had never heard before. I was happy to hear and learn about the other's narrative in an authentic manner".

Regarding the conflict and Jewish-Arab relations, Arab students, both male and female, reported that the course provided them with an experience that they had never before had, neither within the academic setting nor outside of it – the experience of expressing themselves without fear or concern: "During the course I made a conscious effort to express critical opinions and not just be content with remaining silent. I was brought up to be proud of my Palestinian identity, but not openly, for fear that expressing my opinions would close doors to me. In school I was not taught to try to create the world that I would like to see, nor to develop an ideology reflecting things as I see them and I certainly was not given tools for critical examination of my reality. Here I felt safe to express myself and say my opinion out loud."

These courses clearly strengthened and empowered the Arab students: "The truth is, I felt that this lesson is my place to express my difficulties and frustrations regarding all of the issues that disturb me as a member of the Arab minority in Israel. The State and the establishment oppress us and we cannot express ourselves - not in the schools and not in our reality outside. Here I felt safe and I had the confidence to criticize the establishment and raise my feelings of frustration and disappointment. I leave this course feeling strengthened with thoughts about how to take what I learned here and apply it with my own students."

Discussing their experience with the course, several other students also brought up their thoughts about how to apply in their own classrooms what they learned: "When I look ahead to the way in which I want to teach, I think that this course gave me a more complex understanding, enabling me to see the importance and significance of the teacher's work with the students. How important it is to come to the class with broad knowledge and a clear position together with an ability to learn from my students about where they come from, what world that they bring to the classroom and then to help them develop their own perceptions through research and study."

The question of transferring the knowledge they acquired to the field and to the school after they become teachers preoccupied a large number of students: "During the course I kept asking myself the same question. Will I succeed in my task? Can I really create for my students a place that accepts them and listens to them, enabling them to enter dialogue that develops thinking and that raises new points to think about? I have to say that developing

the ability to hear things that go against your opinion, without trying to change the other's opinion or even influence it, is no easy task."

Some of the students began to apply the principles that they learned through exercises that they did during their participation in the course: "Of all of the courses that I took in this program, this was one that contributed to me and accompanied me throughout my teaching experience in the school. I tried the best I could to apply insights from Freire's theory and method of dialogic learning. And that was in order to prove to myself that it is in fact possible to work differently and that there is a place for educational dialogue in the formal educational frameworks – despite the strict supervision in the school system."

5. Conclusions

To conclude this experience, the lessons are usually very lively with much broader participation than that which characterizes the other lessons conducted in a more frontal format. The Arab students, who tend to be less active in other lessons, also find in this course a channel encouraging them to express themselves. The students report on these lessons as a significant experience and as a unique exposure to an approach that is very different from what they learn elsewhere in the college.

While the dialogic approach is actually very difficult to apply in the school, the students' exposure to its principles can enrich them, opening their eyes to aspects of their work of which that they may not otherwise have been aware. For example it turns the students' attention to the importance of respect for their students' and for the knowledge that they bring, the importance of allowing the students to express their positions in class and also the need for the teachers to make their opinions known regarding the topic being taught.

To sum up this experience, which is still in its infancy in the college, resonates loudly in the M.A. courses that I teach. The students often report that their experience in the course is unlike anything else that they encountered during their studies. I personally leave each of these courses feeling strengthened and empowered. Each course and each student teaches me something new about the approach itself and about the educational, social and political phenomena that the students bring to the discussion in the lessons. Furthermore the dialogic approach has a socio-political statement in that it offers a way to deal with the mass of knowledge in our world. While the students are easily exposed to knowledge, they are more likely to require tools for critical reading of the knowledge that swamps them from every direction.

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Objective versus subjective methods to assess discipline-specific knowledge: a case for Extended Matching Questions (EMQs)

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Abstract

Background: Extended matching questions (EMQs) were introduced as an objective assessment tool into third year immunology undergraduate units at Monash University, Australia.

Aim: The performance of students examined objectively by multiple choice questions (MCQs) was compared to their performance assessed by EMQs; there was a high correlation coefficient between the two methods. EMQs were then introduced and the correlation of student performance between related units was measured as a function of percentage objective assessment. The correlation of student performance between units increased proportionally with objective assessment. Student performance in tasks assessed objectively and subjectively was then compared. The findings indicate marker bias contributes to the poor correlation between marks awarded objectively and subjectively.

Conclusion: EMQs are a valid method to objectively assess students and their increased inclusion in the assessment process increases the consistency of student marks. The subjective assessment of science communication skills introduces marker bias, indicating a need to identify, validate and implement, more objective methods for their assessment.

Keywords: *Extended matching question (EMQ); Objective assessment (OA); SA (SA); Marker bias; Discipline-specific assessment; Science communication assessment*

1. Introduction

1.1 Automation of assessment

There are two important reasons academics may be motivated to increase the proportion of assessments that utilize an automated process. The first has a pedagogical ideal, the second is purely pragmatic. The use of essay style questions to probe student knowledge is reported to have been used in China as far back as the 7th century, moving to the west in the mid 19th century (Lederman, 1988). Subjective tools to assess written and oral communication have since then been used extensively. However, a limitation of subjective assessment (SA) is the bias imposed by individual assessors (Langan et al., 2005; Malouff & Thorsteinsson, 2016). The presence of ‘marking bias’ necessitates either the use of multiple assessors for each student, or standardization of marks between assessors, to minimize the problem. Conversely, automated assessment processes require questions that can be marked objectively. The second reason for automation is a fiscal one: many universities worldwide are under increasing pressure to teach a greater number of students without commensurate resources (Blackmur, 2007). Automated processes can alleviate time pressures faced by academics.

1.2 Format of examination questions

Multiple Choice Questions (MCQs) are well established as an automated assessment tool (Moss, 2001), but have several drawbacks that has led some educators to limit their application (Tetteh & Sarpong, 2015). One problem is that they require the posing of numerous spurious answers that are plausible, but wrong, thus creating a culture of mistrust between student and educator. The alternative is to write MCQs as negative questions, requiring the student select one incorrect answer. Whether written in the positive or negative format, the erroneous selection of an incorrect answer risks corruption of the student’s knowledge. This is especially true with the increased adrenaline release associated with the examination experience (Schwabe et al., 2012).

An alternative to MCQs is the Extended Matching Question (EMQ) format, in which a context statement precedes multiple alternative correct answers, followed by related questions. Students inform an examination card with the letters pertaining to the most correct answers, which then undergo automated processing. EMQs have several important pedagogical advantages over MCQs (Beullens et al., 2002; Cramer et al., 2016). Firstly, the context statement serves to focus and settle the student under examination. Secondly, all alternative answers provided to the student are indeed correct, thus reminding the students of what they do know, and creating a positive examination environment. The third, and arguably most powerful, advantage of utilizing EMQs is the potential to write questions that probe the student’s differential knowledge, whereby they are required to distinguish

between two closely related alternatives. EMQs are therefore particularly well suited to health sciences education, where differential reasoning is inherent to successful learning (Beullens et al., 2002).

1.3 Introduction and approach to validate EMQs as an assessment tool

The content of the immunology units into which the EMQs were introduced comprises numerous immunological mechanisms underlying disease processes, requiring students to discern subtle features that distinguish one process from another, lending them well to this assessment approach. Historically these units relied on SA for 75% of the awarded marks, and 25% assessed by MCQs. The motivation for introducing EMQs was twofold: (i) to use a more objective assessment (OA) tool that could assess differential reasoning, and (ii) to promote time efficiency for academics during peak assessment periods.

2. Methods

EMQs were introduced over 3 years and the validity of EMQs measured over the course of the implementation, and for two years after implementation. Within each cohort student performance was measured as the number of correct answers across three examinations. Four approaches were taken to analyse the data. These included comparing the mean mark for each student's performance: 1. In MCQs and EMQs within the unit 2. In two closely related units, as a function of the percentage objective assessment 3. In subjectively and objectively assessed tasks within the unit, and 4. In oral assessment tasks from different marker groups within the unit. For each comparison made the coefficient of correlation was determined using Excel and Prism-graphpad statistical programs. Assessment of variance between marker groups was performed using Kruskal-Wallis nonparametric one-way ANOVA.

3. Results

3.1 EMQs are as valid an objective assessment tool as MCQs

Student performance was monitored within the unit undergoing transition from MCQ to EMQ based assessment. Student performance was collated across three examinations with a total of 150 questions comprising 40% MCQs and 60% EMQs. Each student was compared for their average mark in MCQs vs EMQs. A high correlation coefficient was measured in student performance assessed by these two methods (Figure 1), demonstrating EMQs are a valid OA tool. EMQs were thus introduced in subsequent years and the impact of increased percentages of OA was further monitored.

3.2 Increasing objective assessment did not impact on unit performance

We compared the mean student performance of each year's unit cohort as a function of percentage objective assessment. There was no significant difference in the mean mark of students in any of the years during which the percentage OA was increased from 25% to 72.5% (Mean unit mark ranging between 67.6 ± 9.6 and 69.8 ± 12).

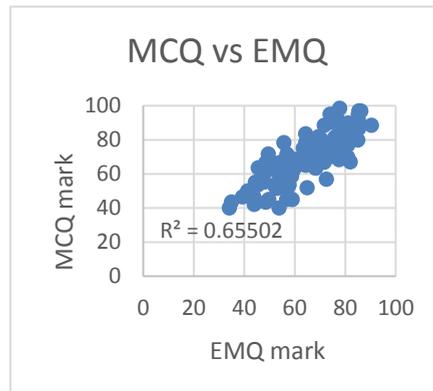


Figure 1. Comparison of performance in MCQ vs EMQ.

3.3 Objective assessment improved the correlation of student performance

Next, it was important to ascertain whether increasing the percentage OA perturbed student ranking. The performance of students co-enrolled in related units was compared across 3 years of transition from 25%-59% combined percentage OA, and 2 subsequent years in which the combined percentage OA was maintained at 59% (Figure 2). The results show that in 2012, prior to the introduction of EMQs, and when each of the units utilized only 25% OA in the form of MCQs, there was a poor correlation of student performance between the two units. In the subsequent year, the first semester unit remained unchanged (25% OA), and EMQs were introduced to the second semester unit, increasing the percentage OA to 65%. This led to an improved correlation of student performance between the units. In 2014 and subsequent years, after increase of the percentage OA to 45% and 72.5% in semester 1 and 2 units respectively, the correlation of student performance increased further. Indeed, the increased OA from 25% to 65%, almost doubled the coefficient of correlation between student performance in the two units (Figure 2 insert). This indicates that OA improved consistency of student performance in the two units, thus validating the reproducibility of OA as superior to that of SA.

3.4 Objectively and subjectively awarded marks were poorly correlated

The stronger correlation of student performance between units provided by OA raises questions about the accuracy of SA to measure student performance. To address this issue, we compared student performance measured by OA versus SA within the same unit.

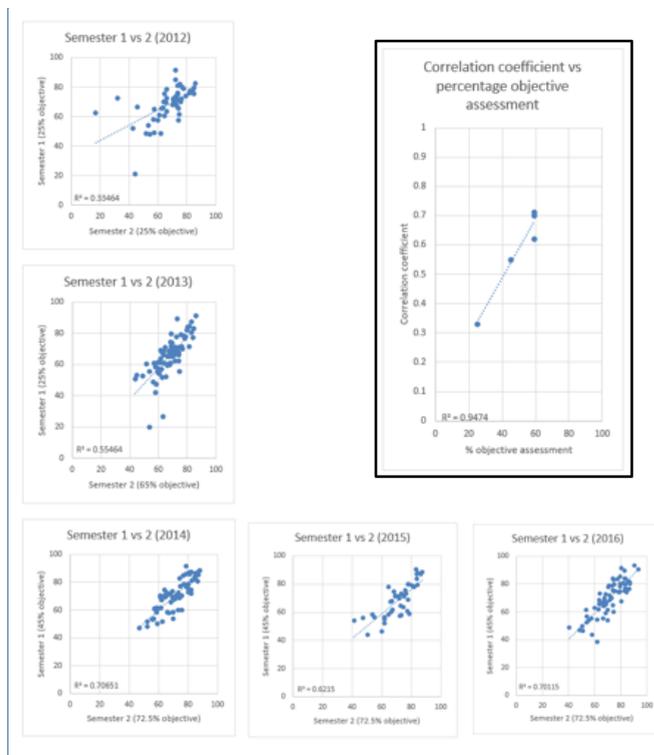


Figure 2. Comparison within the student cohort of performance in related units with increasing percentage objective assessment. Insert: Correlation of student marks as a function of percentage objective assessment.

3.4.1 Written and oral assessments versus EMQ

Prior to undertaking the written assessment task, students were required to read, interpret, and summarize in tabulated form, scientific data from two manuscripts. After receiving written and verbal feedback from a mentor, students wrote an essay discussing the data. Essays were subjectively assessed by markers against a rubric that defined the apportioning of marks for specific attributes present in the essay. Student performance in the written task was compared with that in OA (EMQs). There was a poor correlation between performance in the written assessment and performance measured objectively, despite clear marking guidelines and a marking rubric (figure 3a upper panel).

The oral assessment task was also the culmination of a formative learning process that required students to engage in critical problem solving in a small group setting, facilitated

by the tutor. Students were then required to orally present their solutions to the assessing tutor. Each student presented orally seven times throughout the semester. Oral assessment marks were compared with performance in OA (EMQs). Despite the fact that tutors were given assessment guidelines and advised to use the full spread of marks, there was a poor correlation between student performance in the oral assessment, measured subjectively, versus performance measured objectively by EMQs (Figure 3a lower panel).

The poor correlation between OA and SA is striking. It may be that student aptitude and confidence in the skills required to perform well in these tasks is poorly correlated with their ability to perform well in EMQ-based examinations. Another potential explanation for the poor correlation is the subjectivity in the allocation of marks for student performance in these tasks.

3.4.2 Marker bias in subjective assessment

To determine whether marker bias was consistently associated with specific individuals we compared the marks awarded by individual markers with marks awarded objectively for each student. While there was a high coefficient of correlation between the marks awarded by marker 1 for the oral communication task and those awarded objectively (correlation coefficient 0.66), there was no such correlation for any of the other five assessors (correlation co-efficients ranged between 0.00-0.19). Furthermore, the variance in awarded marks was not significantly correlated between marker groups (Kruskal-Wallis one-way ANOVA, Figure 3b). These data strongly suggest assessor bias is at least a contributing factor to the poor correlation between OA and SA.

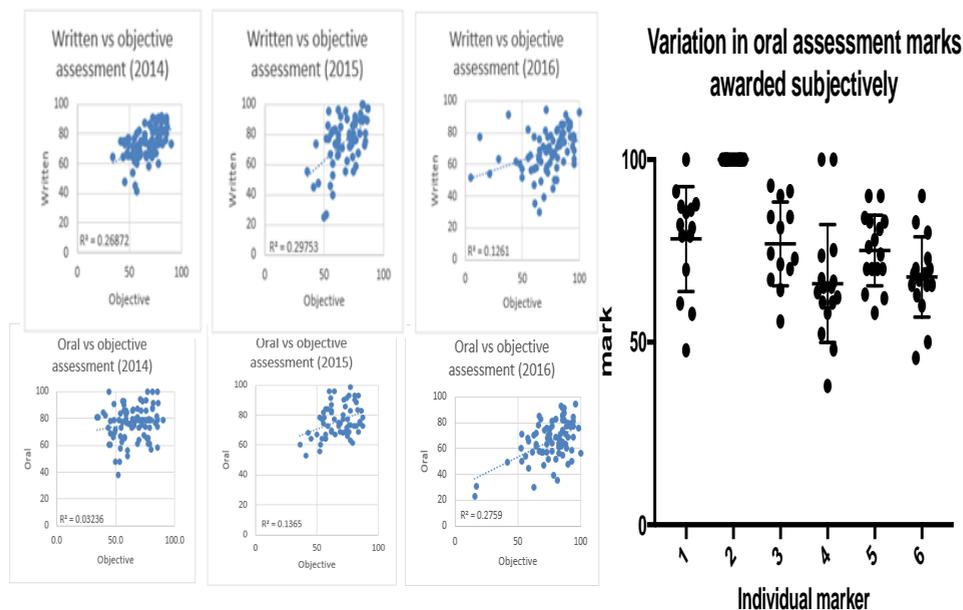


Figure 3. (a) Comparison of performance in written (top panels) and oral (bottom panels) assessment tasks versus objective assessment. (b) Variation in mark awarded by individual markers.

4. Discussion

EMQs were introduced to the capstone units of the final year Immunology course for two reasons. First, EMQs are superior to traditional OA and SA methods in their ability to probe student knowledge and its application to problem solving –this advantage of EMQs is important because problem solving ability is essential for students preparing to enter the professional community. The second motivation for introducing EMQs was to relieve the pressure on academics during peak work loads. The reported ability of EMQs to deeply penetrate the knowledge and problem solving ability of students has been documented (Bullens et al., 2002). However, the introduction of changes to assessment methodologies has the potential to introduce new variables that must be managed. Here we show there was a high degree of correlation between performance in EMQs and MCQs, and conclude that EMQs are as valid an OA tool as traditional MCQs. Because of the increased challenges inherent in problem-solving style questions, and student perception that EMQs are more difficult than MCQs, we further analysed whether the mean mark was decreased by the introduction of EMQs. The finding that there was no difference in the mean mark associated with the introduction of EMQs is important; not only does it validate the fairness of this approach, it also was an important statistic to provide students at the beginning of semester to develop their confidence in OA by EMQ. The shift towards an increased percentage OA improved the correlation of student performance between related units,

demonstrating the reproducibility of OA. Conversely, the poor correlation of student performance in written and oral assessment tasks measured subjectively, and EMQs measured objectively, raises important questions. How much of the lack of correlation is due to variance in student aptitude for the tasks under assessment, and how much is due to marker bias? It is difficult to independently measure student aptitude without compounding the question by the method of assessment (Damon, 2007). However, it was possible to independently measure marker bias by stratifying the data into individual marker groups. It is clear that marker bias significantly influences the scatter of marks and drives the poor correlation between OA and SA. Such unreliability of marking has been reported to occur despite provision of clear marking criteria, and is proposed to occur because of the complexity of assessment decisions (Bloxham et al., 2016).

While other influences, such as student aptitude, may also contribute to the discordance of student marks, the fact remains that SA approaches are limited by marker bias (Hathcoat et al., 2016). Automated assessment technology is clearly superior to human grading for written assessment tasks (Heit & Donaldson, 2016; Horn, 2009). Objective approaches need further exploration by the international education community to lead the pedagogical field towards the implementation of cross-validated, objective processes, to assess students' written and oral science communication abilities.

In conclusion we have shown that EMQs are a valid assessment tool and their inclusion strengthens the reliability of the assessment process, because they are objective. Notwithstanding the importance of written and oral communication skills in science graduates, we propose that all discipline-specific components of scientific units be assessed objectively. And that communication skills, which are not assessable by EMQs, be assessed independently by a broad academic audience of sufficient size and diversity to obviate assessor bias. This would more closely represent the global audience with whom our students will professionally engage, once graduated.

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Using Blog Comments as Feedback to Promote the Metacognitive Development of Creativity

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Abstract

Creativity can be viewed, not just as a set of skills and strategies, but as an overarching metacognitive skill that integrates a range of subordinate generic skills. Key to developing creativity is to engage in a cycle of ideation, reflection and adjustment, within a feedback rich environment. Blogs have the ability to garner external comments that can prompt these processes. Case study research was undertaken to explore what forms of feedback promote metacognitive development and how those forms can best be elicited within a blog. Findings indicated that blog comments can motivate, provide information, enhance quality and promote reflection, and that a range of strategies can be applied in blogs to best obtain the most valuable forms of feedback for creative development.

Keywords: *weblogs; blogs; feedback; metacognition; creativity, reflection.*

1. Introduction

One approach to teaching creativity is to teach *for* creativity rather than simply modeling creative strategies (Kaufman & Sternberg, 2007). As a generic skill, it can be addressed through a range of related skills and attributes, such as critical thinking and information literacy. Clements and Nastasi (1999) foreground the role not of knowledge itself but knowledge acquisition strategies. Such strategies ‘relate newly acquired information to information acquired in the past. Knowledge-acquisition components are fundamental sources of learning, insight, and creativity.’ (Clements & Nastasi, 1999, p. 12)

Associated skills that have been identified include information management, self-organisation, and ability to manage risk as well as reflection, self-evaluation, and interpersonal skills (Gourley, 2003). This positions creativity as a metacognitive skill that is applied and developed through a high level of self-awareness within the practitioner.

This paper outlines a case study undertaken by an honours research student using a blog as a tool for personal creative development within the context of game concept art. The blog provided the basis for publishing his developing art over a 6 month period. The aim was to explore how a metacognitive view of creativity could inform creative development, with a particular focus on the value of feedback garnered through blogging in supporting the iterative processes of ideation, reflection and adjustment required to evolve creative ideas.

2. A Metacognitive Approach to Developing Creativity

Perfect and Schwartz (2002) synthesise much of the literature on metacognition as a concentration on the interactive mechanisms of monitoring and control, in relation to achieving a certain goal. Monitoring refers to an individual’s ability to judge their cognitive processes, and control refers to their ability to adjust and strategize from this knowledge. This identifies the relationship between creative thought (creativity-relevant skills) and the creative act (domain-relevant skills). Metacognition in this sense is comprised of three components: (a) awareness of a problem; (b) planning and engaging the appropriate strategies to address it; and (c) monitoring and regulating the ongoing activity.

This inherently reflective approach is also manifest in models of creative agility, involving the pursuit of a particular goal (awareness), reflecting on the outcomes of ideas (monitoring), and adjusting (controlling) the initial approaches based on learnt options from that reflection (Hill, Brandeau, Truelove, & Lineback, 2014). Creative agility does not assert that it is the one single process for creativity, rather that it mediates a range of subordinate processes such as generating ideas through debate, iterating them multiple times, integrating decisions based on goals, reflection, and adjustment, identifying problems and solutions, and so on.

This study was informed by a model that synthesises this research (Figure 1). The key elements are both the creative and domain relevant skills as well as intentionality and feedback to mediate their development. This mediation is conducted through the metacognitive act of ideation, reflection and adjustment.



Figure 1. A metacognitive model for creative development

3. Method

The model was applied by an undergraduate honours student in Design through the implementation of a weblog, which acted as a visual diary, with the added affordances of communication enabled through online publishing. Posts included examples of work in progress, discussions of key themes and influences, reflections on the work as it developed and responses to feedback. Participants were recruited to provide the feedback in the form of blog comments. They included undergraduate students in Design from the same university, where critiquing the blog posts constituted a classroom activity about game concept design. Invitations were also sent via game art forums and online communities.

Feedback in the form of participant comments were then analysed to classify types of feedback with a view to identifying those that best inform creative development and provide recommendations as to how to elicit the most useful types. A constant comparative approach was used to continuously analyse comments over time, involving a variety of coding techniques

4. Findings

Existing research has shown that feedback can have a range of functions that provide information, boost motivation, clarify standards, facilitate reflection, and assist in skills development (Ion & Stîngu, 2014). In combining these precepts with trends that emerged directly from the comments themselves, four roles for feedback became apparent that provided a strong basis for organizing discussion and analysis of the value of feedback in: providing information to assist skills development; strengthening motivation; prompting reflection; and facilitating good performance

4.1 Providing Information to Assist Skills Development

Throughout the blog feedback, there were many instances where information was provided to assist skills development. The first key finding with regard to this was the somewhat obvious one that to receive information that supports the development of skills, an object is required that encourages participants to talk and direct their attention. Simply posting the artwork provided many positive comments but little actual information beyond congratulations and encouragement.

Better examples were when the artist posted drawings practicing the female form. These were deliberately rough in nature (Figure 2), and were accompanied by a brief discussion on human body shapes and structures that identified the drawings' need for a realistic body shape for the video game heroine. More valuable comments were then received that directed the artist to 'study how the body parts are made up of bones, sinew, musculature and fat tissue' (Participant 4) and drew attention to the anatomical drawings of Leonardo da Vinci. The external reference point of anatomical drawings enabled the recognition of weaknesses, the ability to calibrate understandings with those of others and respond by refining the work in a way that enhanced drawing skills.



Figure 2: Rough female anatomical drawings

A second published artefact focused on integrating ideas about personality, aesthetic design and environment into a female form. The post cited multiple video game and film media. These examples enabled commentators to dissect the artefact and draw conclusions, with comments such as '...the tightness of her clothing demonstrates just how guarded she is...' (Participant 5) while another suggested art styles in Games such as *Limbo* and *Feist* for further inspiration (Participant 6). Such comments that added to the context of the drawing, furthered skills both in terms of technical (drawing) and conceptual aspects (setting, character etc.).

4.2 Strengthening Motivation

Motivation can be seen as a major contributing aspect of metacognitive self-regulation (e.g. Boekaerts, 1997; Garcia & Pintrich, 1994). It moderates effort, which in turn assists in mastery of skills. One of the strongest values of feedback in this blog was its power to motivate the artist. While comments such as feedback such as 'Love this! so creative!' (Participant 1) or 'Freaky fun. Luv it' (Participant 2) do not provide information for further learning, they do provide validation and encouragement that stimulates further actions to

reach desired ends. Published artefacts such as that shown in Figure 4 were particularly effective in prompting motivational feedback.



Figure 4: Evolution of female anatomical drawing

This post demonstrated how the work shown in Figure 3 was evolving and elicited comments such as, ‘brilliant artwork’ (Participant 7), which in turn stimulated the desire to achieve goals by boosting self-esteem (creativity-relevant skills) and self-control (domain-relevant skills). It validated the improvement of skills compared to previous work. One comment was particularly notable in that it pointed out aspects that were realistic and feminine but also pointed to specific design characteristics and illustrative techniques (Participant 8). While the comment did not provide sufficient information from which to develop skills, it did present a sense of appreciation that enhanced effort. The consideration given to what kind of works to make, how to go about doing so, and how to present them, in particular enhanced the credibility of the comment as well as prompting reflection.

A trend became apparent where artefacts that were published with a low level of refinement feedback were more likely to elicit formative than summative feedback. This may be because such works provide the community with an aesthetic quality to engage with, which further enhances the detail within the feedback, and therefore its credibility. However, although motivational feedback is valuable in sustaining one’s drive to achieve a creative goal, a balance needs to be struck. Praise helped regulate the artist’s effort but did not necessarily lead to specific skill development.

4.3 Facilitating Good Performance

One of the other problems with purely motivational feedback is that it fails to provide the means for objective judgement of performance. A few highly praiseworthy comments could skew the perception of the work, particularly with regard to its value as perceived by the broader community.

To address this, two designs were presented and the participants were asked to select which one they preferred and why (Figure 4). This provided some statistical information as well as informative comments. 63% of comments chose Design A but it was only when reviewing

the reasoning that it became apparent why. In that sense, statistical information fails to provide knowledge about what is successful about a work but when one participant commented that the preferred image ‘definitely fits the character description ... [has] way more details in it too ... [and] the smokey affect gives me more of that feeling that he’s a drug addict and an alcoholic’ (Participant 11), clear reasoning could be found for the general consensus provided by the statistics.



Figure 4: Two designs compared

The combination of both ‘what’ and ‘why’ were essential to good performance in that statistical summary can provide an objective measure which can then be triangulated with reasoning to facilitate good performance. In this particular case it honed the design in terms of its ability to embody the contextual elements of the game world.

4.4 Prompting Reflection

Reflection is perhaps the key metacognitive element for the development of creativity since it underpins the self-monitoring inherent in most of the metacognitive models. Feedback would appear to be a powerful tool as a reflective prompt but as has been shown, comments can reinforce existing biases through praise or simply provide information. This research found that certain types of comments were more valuable for prompting reflection and that specific strategies were also more successful in eliciting those types of comments.

What differentiates feedback for reflection from other forms is how it extends on the information provided to prompt individuals to consider their performance against some criteria. Using Image B of Figure 4 as an example, the artefact was published with a back-story which contextualised and broadened the character. This promoted richer feedback by providing specific features to discuss:

Participant 12 pointed out a lack of originality in the character, with its similarity to characters in *Diablo 3* and *World of Warcraft* as well as some gaps in logic (such as the ‘fat’ neck and ‘funny’ muscles), which in turn prompted reflection on those aspects of the design that were clichéd or inaccurate. It is important to note the comment did not define exactly how to proceed with the mentioned adjustments, it did provide external reference

points that enabled the original idea of the character to be re-addressed. As a result, the purpose and effect of every feature was reanalyzed for its coherence.

As an internal thought process, reflection is not mediated by feedback but prompted by it, with the ultimate goal of the snowballing iterative cycle of ideation and adjustment shown in Figure 1. The best feedback for reflection, then, should inspire and introduce new ideas but not lay down the path of how to necessarily execute them. This should involve connecting the current state of the creative artefact (awareness) with its intended goal (monitoring) through evaluation (controlling). From this, metacognition grows knowledge and enables one to exercise control of that knowledge. Eliciting feedback that challenges one's own assumptions, therefore, is an important strategy for prompting reflection to enhance metacognitive development of creativity.

5. Conclusions and Recommendations

As has been shown in this case study, feedback is a potent tool to promote the metacognitive development of creativity. Blogs are a natural medium for this as they provide both the creative flexibility of publishing ideas and artefacts while engaging broadly with a community to garner comments. That said, consideration needs to be given to the different types of feedback received. A variety of forms are required to ensure that they provide information, motivate, facilitate good performance and prompt reflection. Many social media environments allow people to post work and gain comments such as 'likes', providing a statistical and objective base to count the perceived value of a post by others. However, without comments they do not provide remediation, support, or extra information. Open ended blogging environments such as *WordPress* can enable richer interaction but consideration still needs to be given to what artefacts are posted and how comments are elicited to maximize the value of feedback for creative development. With that in mind, the following recommendations are made:

1. Information which assists skills development is most beneficial when feedback articulates specifics about the published artefact and provides additional information to extend learning beyond initial ideas. This is best elicited by creative works that are published with an accompanying written elaboration from which the community can draw on, to provide informative and detailed feedback.
2. Feedback which strengthens motivation is most valuable when the feedback firstly praises the artefact and secondly draws attention to elements that deemed the artefact praiseworthy. Eliciting this kind of feedback requires published artefacts with high levels of refinement.
3. The best kind of feedback for good performance is where feedback allows for some kind of objective analysis. One way is to request a level of detail in

comments to gauge their credibility and validity. Another is to create an objective measure such as a polling system. The number of likes or votes can allow the judgment of how well a post has resonated with the audience.

4. The most valuable feedback to prompt reflection identifies the artefact's goal, draws on aspects of the artefact to provide new perspectives outside of the individual and encourages reflection on this information in terms of one's own performance. This can be elicited through publishing written elaboration with the artefact showing clear sense of goals and generate sufficient detail in the artefact to prompt links between the current state in contrast to the desired state. This then facilitates how to identify and evaluate alternatives and then select a solution.

As environments that give artists opportunities to present ideas, reflect on them, and adjust them within a feedback rich environment, blogs are an ideal medium to assist in the metacognitive development of creativity. In this socially mediated world, understanding the nature of different types of feedback and having an ability to elicit the variety of types required to motivate, inform, build quality and prompt reflection will be key skills for higher education students who seek to enhance their creativity as developing artists.

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Making friends with your team: The benefits of raising learner awareness of intra-team relations

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Abstract

To highlight the importance of teamwork and intra-team relationships beyond the classroom, in a small study population of undergraduate students of Translation studies, we have attempted to raise awareness of teamwork processes so as to empower learners in managing their interaction and ensure they gain valuable pre-professional experience. Following specific input and the construction of randomized teams, we questioned learners about their previous and current experience of teamwork, their knowledge of team colleagues and the changes their relationships underwent, and prior academic performance versus expectations of current performance and how teamwork might influence this. Our results indicate teamwork substantially improved levels of intimacy, enhanced the quality of the experience, and raised awareness of the benefits of the team per se. However, some learners recognized personal difficulties with teamwork that they were unable to overcome and, in this context, “people problems” became increasingly important. Nonetheless, learners were convinced that teamwork would have a positive influence on their final grades.

Keywords: *Tertiary education; Teamwork competencies; Intra-team relations; Translator training.*

1. Introduction

Post-Bologna tertiary education embraces a broad-ranging concept of learner training with a specific focus on graduate employment prospects. Hence, generic competencies relating to the workplace form an integral part of undergraduate programs. However, in Translation Studies—and elsewhere?—learners generally remain unaware of the importance of teamwork and intra-team relationships and believe that teamwork has little relevance beyond the classroom. Foregrounding teamwork-related competencies (Robinson et al. 2016) to raise awareness of the processes involved should empower learners in managing their interaction and ensure they gain valuable pre-professional experience. Here, we look at three areas of team interaction and their relations with facets of learner experience: (1) learners' conclusions about their teamwork experience versus their experience during the current module; (2) learner knowledge of colleagues and the changes their relationships undergo; and (3) prior academic performance, expectations of current performance, and learner perceptions of the influence teamwork might have on performance.

1.1. Awareness-raising input

To raise awareness of team processes and encourage learners to be proactive in dealing with issues arising from interpersonal interaction, task fulfilment, leadership, decision-making and conflict resolution we have drawn on business management and training (Birkenbihl 1977; Tuckman 1965), and elicited the experience of earlier cohorts to provide input on the theory and practice of small group learning (Robinson 2017). We discuss group formation and intra-group processes that receive little attention in tertiary education (Robinson et al. 2015). We describe Tuckman's four-stage model so learners can appreciate that Forming, Storming, Norming and Performing are normal, natural processes they need to understand, accept and manage to benefit themselves and their colleagues. Earlier cohorts had expressed apprehension about teamwork (Robinson 2017) so our objectives for this input have been:

- To identify and define Tuckman's four stages in the life of a team
- To identify crucial points in the group formation process, and
- To encourage a proactive response to "crises" so learners can see how
- To manage these "crises" and advance in team and task development
- To distinguish between cooperative and collaborative learning
- To promote genuine, interaction through cooperative learning
- To highlight the difficulties and underline the advantages of iterative interpersonal interaction in cooperative learning
- To allay learners' quite reasonable fears
- To encourage learners to see the negative aspects of teamwork as obstacles that can be overcome

- To reassure learners by quoting learners from earlier cohorts who had concluded that the positive aspects of teamwork outweigh the obstacles.

1.2. Objectives

The present study seeks to determine the nature and level of impact on learner awareness of intra-team interaction processes. Specifically, we hope to establish whether or not learners are more aware of (1) the added value of the team *per se* in improving task performance; (2) the individual's responsibility to contribute to team performance; and (3) the potential personal and academic benefits of making a commitment to the team.

2. Method

This is a quantitative study of data collected via a Google Forms online survey and represents part of ongoing research based on learner-generated materials published elsewhere (Robinson et al 2015, 2016 Robinson 2014, 2015, 2017). The learner population (n=31, respondents = 22 (71%)) came from a Specialized Translation module taught at the University of Granada (Spain). The module is delivered using a cooperative, project-based, methodology (Olvera-Lobo et al. 2007) involving randomly assigned teams (Robinson et al. 2015). Course assessment is continuous (60%)— three team translation tasks plus an individual midterm examination—and summative (40%)—an individual final examination. Final assessment favors the individual (55%) over the team (45%).

2.1. Participants

Demographic data show the group was typical of our context: 82% (18) women; age 20-23 (mode 21 years (15)); 86% (19) native speakers of Spanish, 13.5% (3) speakers of other European languages; 81.8% (18) from the University of Granada, 18.2% national or European exchange students; 95.5% (21) following programs in Translation Studies.

2.2. Instrument

Participants accepted a declaration of informed consent before providing demographic data. Then identified their team and labeled colleagues as "Person A", "Person B", and so on.

3. Results

3.1. Previous experience of teamwork vs. current experience

We asked learners to describe their previous experience of teamwork on a five-point scale ranging from 1 = Terrible to 5 = Excellent. They then recorded the best and the worst parts of that experience before responding to similar items about the current module

Prior experience of teamwork was positive with 94.5% (21) choosing options three or four (Fig. 1). Responses referring to the current module ranged across the scale but the clear

trend was towards “Excellent”. Some 40.9% chose “Excellent” and another 40.9% chose option three or option four. However, four learners chose option one (“Terrible”) or option two. To seek explanations for these responses we analyzed the short answer items, categorised topics, and quantified responses (Tables 1 and 2).

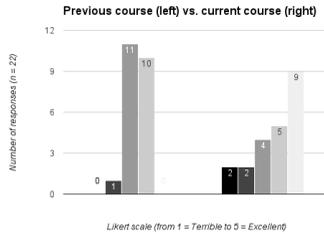


Figure 1. Prior experience of teamwork vs. current experience

One learner reported that nothing had been good about his or her prior experience and three stated nothing had been bad. Six respondents considered that the best part of teamwork was learning from others and four signalled the benefits of positive interaction to produce the translation product. Learners were positive about the motivating stimulus they received when working with others and the benefits of feeling supported; the advantages of organizing and sharing work; and the resulting speed with which they completed their work.

Table 1. Best vs. worst of prior experience of teamwork

Best parts	N° responses	Worst parts	N° responses
None	1	None	3
Learning from others	6	Collective decision-making	1
Dividing/sharing the work	3	Logistics of meetings	5
Productive interaction	4	Modus operandi of individuals	2
Motivation and support	3	Antipathy towards others/teamwork	3
Speed	3	Time	1
		Communication	1
		Lack of commitment/responsibility	6

Negative experiences centered on the lack of responsibility and/or commitment of others; the inevitable frustration at finding it difficult to arrange meetings; problems arising from the work styles of specific individuals; and individual’s personal difficulties when working in teams.

Table2. Best vs. worst of current experience of teamwork

Best parts	N° responses	Worst parts	N° responses
None	2	None	9
Learning from others	4		
Dividing/sharing the work	2		
Productive interaction	6	Modus operandi	4
		Antipathy towards others/self	3
		Time	4
Motivation/commitment/personal growth/responsibility of colleagues	7	Lack of commitment/responsibility	3
		Conflict	1

Two learners found nothing good about the current module and nine found nothing bad about it (Table 2). All the “best parts” are related to the processes involved in fulfilling team tasks and personal attitudes shown by colleagues. Seven negative comments focussed on “people problems”: relating to colleagues and individual difficulties in interacting successfully; lack of commitment or responsibility; conflict; antipathy towards others; and a personal difficulties when working in a team.

3.2. Interpersonal relations within teams

We asked our respondents how well they had known each other at the start and how well they knew each other at the end of the course. Responses were on a five-point scale: Not at all. Acquaintance. Casual friend. Close friend. Intimate friend. Table 3 illustrates changes in the level of intimacy of relationships over 12 weeks.

3.3. Effects of randomization

Randomization created teams in which 66% of relationships were between individuals who stated they knew each other “Not at all”; 28% were categorised as “Acquaintance” or “Casual friend”. Only 2.3% described another person as an “Intimate friend”. Hence, we had genuinely created teams of individuals who were new to each other. Consequently, we could expect changes in the degree of intimacy of their relations to appear over the semester. We classified changes in the level of intimacy from “Minus 2” through to “Plus 3” (Table 4, Fig. 2).

Some 29.5% of relations showed “Zero change”. These mainly represented learners who began and ended the course without getting to know one of their colleagues (9.1%); a further 10.2% remained at the Acquaintance to Acquaintance level.

Table 1 Course initial vs. course final levels of intimacy

	Initial relations n = 22; n° colleagues = 4		Course-final relations n = 22; n° colleagues = 4	
Not at all	65.91%	(58)	11.36%	(10)
Acquaintance	19.32%	(17)	43.18%	(38)
Casual friend	9.09%	(8)	31.82%	(28)
Close friend	3.41%	(3)	7.95%	(7)
Intimate friend	2.27%	(2)	3.41%	(3)
No comment	0.00%	(0)	2.27%	(2)
Total responses	100.00%	(88)	100.00%	(88)

In contrast 63% of relationships increased in level of intimacy by one, two or even three degrees. Some 34.1% of relationships changed from “Not at all” to “Acquaintance”; 17% from “Not at all” to “Casual friend”; and a further 3.4% changed by three levels from “Not at all” to “Close friend”.

Table 2. Changes in levels of intimacy

Degree of change	Initial relations	Course-end relations	Percentage instances (n)
Minus 2	Casual friend	Not at all	1.1% (1)
Minus 1	Acquaintance	Not at all	1.1% (1)
Minus 1	Not at all	No comment	1.1% (1)
Zero change	No comment	No comment	1.1% (1)
Zero change	Not at all	Not at all	9.1% (8)
Zero change	Acquaintance	Acquaintance	10.2% (9)
Zero change	Casual friend	Casual friend	4.5% (4)
Zero change	Close friend	Close friend	2.3% (2)
Zero change	Intimate friend	Intimate friend	2.3% (2)
Plus 1	Not at all	Acquaintance	34.1% (30)
Plus 1	Acquaintance	Casual friend	9.1% (8)
Plus 1	Casual friend	Close friend	2.3% (2)
Plus 1	Close friend	Intimate friend	1.1% (1)
Plus 2	Not at all	Casual friend	17.0% (15)
Plus 3	Not at all	Close friend	3.4% (3)
			100.0% (88)

These changes were contrasted in four instances: one respondent initially selected “No comment” with respect to one relationship and maintained this at the end of the course; another first selected “Not at all” and finally selected “No comment”; a third described a loss of intimacy of one level—from “Acquaintance” to “Not at all”; and a fourth respondent described a loss of two levels—from “Casual friend” to “Not at all”. These responses may indicate prior conflict or superficial relationships that deteriorated over the semester.

3.4. Influence on grades

We asked learners to report their grade for a similar module and their expectations for the current module. Figure 3 shows that 40.9% had achieved a Credit but 4.5% had failed the previous module. However, expectations were high with 77.3% expecting a Credit and 0% expecting a Fail. Interestingly, 13.6% reported a Distinction on the previous course and the same percentage expected to earn that same grade on the present module.

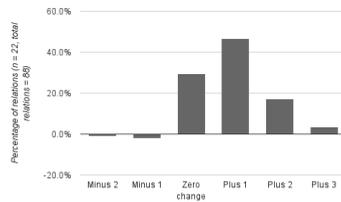


Figure 2. Degree of difference in relations

Some 63.6% stated that the teamwork option would influence their final grade and 77.3% believed this influence would be positive.

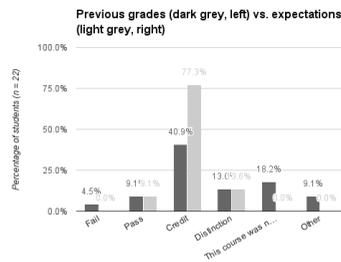


Figure 3. Previous grades (blues) vs. Expected grades (red)

4. Conclusions

In the present limited, small-scale study, we have found that:

- In randomized teams with 66% of new relationships, teamwork substantially improved levels of intimacy beyond mere “working relationships”
- Though prior experience of teamwork was good, on the module under study the quality of that experience was enhanced
- While some participants were already aware of the benefits of learning from each other, mutual motivation and support, an increasing number expressed their appreciation of these factors
- A few learners recognized personal difficulties with teamwork that they were unable to overcome
- Lack of commitment and lack of responsibility were “people problems” that became increasingly important on the module under study
- Learners were convinced that teamwork would have a positive influence on their final grades.

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Undergraduates' Views of Assessment in Higher Education: A Study carried out in Portugal

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Abstract

This paper looks at how undergraduates look at assessment in Higher Education. It focuses on their views about assessment practices in five Portuguese public universities. The main purpose is to look at the students' perceptions of assessment in higher education taking into account the assessment methods used, the influence of assessment in their motivation to learn as well as self-regulation of the learning process. Data were collected through questionnaires in five Portuguese Public Universities in different fields of knowledge. An intervention project focused on Assessment for Learning (AfL), with students enrolled at an Engineering programme, in one public university in Portugal, in one course with student-centred methodologies and AfL practices was also carried out and evaluated. Preliminary findings are presented according the categories emerging from the data. Issues of assessment methods, the connection between teaching, learning and assessment as well as the impact of AfL environments on students' perceptions are analysed. Implications of the findings for assessment, teaching and learning process are discussed.

Keywords: *assessment; undergraduates; higher education; teaching and learning.*

1. Introduction

The assessment of the students' learning has been subject to discussion and debate (Sambell et al., 1997; Black & Wiliam, 1998; Struyven et al., 2005; Pereira et al., 2016). Different perspectives suggest that a shift in the assessment paradigm has occurred, based on the transition from an instructional paradigm to a learning paradigm (Barr & Tagg, 1995), from a summative 'testing culture' to an integrated 'assessment culture' (Birenbaum, 1997), or, in other words, from a teacher-centred approach to a learner-centred approach (Huba & Freed, 2000; Kahl & Venette, 2010).

After the implementation of the Bologna Process, the renewed framework in the curricula has brought about changes with implications for teaching, learning and assessment methodologies. This "new" educational paradigm recognises the key role of students in their learning process based on autonomy, shared work and project-based work (Flores & Veiga Simão, 2007). In this context, the need for developing Assessment for Learning (AfL) approaches in higher education has been identified (McDowell et al., 2011). As Swaffield (2011, p. 441) argues, AfL is a teaching and learning process and the main concern is "with the here and now of learning". Literature has shown that AfL practices stimulate students' engagement in a more active way, providing them with more positive formative experiences, such as: greater teacher support, flexible curricular design, dialogue opportunities, peer learning and research opportunities (Black, Harrison, Lee, Marshall, & Wiliam, 2005; McDowell et al., 2011). The development and assessment of these practices implies the adoption of a wide array of assessment methods and fewer tests; feedback to report students' strengths and weaknesses; opportunities to overcome weaknesses, to work in a collaboratively way and to carry out peer or self-assessment; sharing with students the goals of learning and the use of assessments tasks that enhance creativity and understanding rather than memorisation of knowledge (Carless, 2005).

The aim of this paper is to analyse assessment practices in Portuguese higher education settings from the perspective of undergraduates in five Portuguese public universities.

The main purpose is to look at the students' conceptions of assessment in higher education taking into account the assessment methods used, the influence of assessment in their motivation to learn as well as self-regulation of the learning process. Although there are studies focusing on students' conceptions of assessment and their impact on learning (Brown & Hirschfeld, 2008; Fletcher et al., 2012; Gibbs & Simpson, 2004) more needs to be done in regard to students' beliefs related to assessment practices, as well as the relationship between their beliefs and the processes of teaching and learning (Brown & Hirschfeld, 2008). As Biggs (2003) suggests, the ways in which students see assessment will affect their involvement in the learning process. In Biggs' perspective, while in the assessment process cycle, teachers first see the objectives, learning outcomes and learning

activities and only then look at assessment, students see assessment first of all and only afterwards look at learning activities and the outcomes. Furthermore, earlier literature suggests that the ideas that students associate with assessment are related to their area of knowledge as well as the assessment methods used by their teachers (Pereira, Niklasson, & Flores, 2016; Pereira, Barros, & Flores, in press). In other words, assessment influences, either negatively or positively, student learning and may be seen as an incentive for study and for improved performance (Watering, Gijbels, & Dochy, 2008; Biggs, 2003; Brown & Knight, 1994; Brown, Bull, & Pendlebury, 1997; Boud & Falchikov, 2007).

MacLellan (2001) also concluded that students do not take advantage of assessment to improve their learning and, consequently, have an underdeveloped conception of what assessment is. In addition, “students who conceive assessment as a means of taking responsibility for their learning will demonstrate increased educational outcomes” (Brown & Hirschfeld, 2008, p. 3).

2. Method

This paper draws upon a wider piece of research within the context of a project entitled "Assessment in Higher Education: the potential of alternative methods" funded by the Portuguese Foundation for Science and Technology - (PTDC/MHCCED/2703/2014).

The study is at an early stage and aims to identify and contrast practices and conceptions of assessment in five Portuguese public universities from the perspectives of students through the administration of a questionnaire. The participants are undergraduate students attending the 1st, 2nd and 3rd year in different areas of knowledge in 5 Portuguese Public Universities. In this study the four scientific fields of research identified at the Portuguese Foundation for Science and Technology were used: Hard Sciences (HS), Social Sciences (SS), Health and Medical Sciences (HMS) and Engineering (E). Different programmes were selected in each field: HS: (Mathematics, Physics and Optometry); SS: (Economics, Law, Education, Basic Education and Psychology); HMS: (Medicine and Nursing) and E: (Biological Engineering, Biomedical Engineering, Civil Engineering, Industrial Management and Engineering and Mechanical Engineering). The questionnaire was administered to the students in person in one of the classes with the permission of the teacher. A research protocol was sent to each university and department as well as to the Dean of each Faculty in order to request permission to conduct the study. Data were analysed through SPSS. Data reported in this paper were also collected through the development of an intervention project focused on AfL, with students enrolled at an Engineering programme, in one public university in Portugal, in one course with student-centred methodologies and AfL practices. The selection of Engineering was associated with the high rate of students' failure and dropout. In total, 70 students participated in this phase where monitoring strategies of teaching,

learning and assessment and an AfL questionnaire were applied. The study developed was approved by the UMinho Ethics Committee. Data were analysed through SPSS and through content analysis.

3. Findings

Preliminary findings suggest that in the students' perspective assessment practices used by university teachers may have an impact on their performance and attitudes towards learning and assessment. Furthermore, students claim that assessment is more effective when it allows the development of both technical and soft skills and when it relates to a real practice in a real context or situation having a positive impact on the quality of learning. Students also perceive assessment as more effective when it promotes deep learning. The participants also associated assessment with neutral ideas such as tests or exams and grades, or positive ideas such as learning or verification of knowledge. Nevertheless, the negative associations such as anxiety or fear have also some of the higher means.

Findings from the intervention project provide an analysis of the implications and potential of AfL in the teaching and learning process. Findings also look at the impact of AfL on students' perceptions about assessment of their learning. According to students' perspectives, assessment in AfL environments tends to be demanding, continuous, fair, well-adjusted and different from usual. Also, students highlight positive aspects related to AfL approaches, such as: development of technical and transversal competencies, tutoring, creativity development, practical component, autonomy, team work, teachers' support, active teaching methodologies and problem-based work. By contrast, time management and articulation of different topics were identified by students as the main difficulties in their learning process. Students also pointed out strategies used to overcome difficulties in the learning process, such as: internet research and tutorials, teachers' support, support and peer learning.

4. Conclusions

The perceptions of students, as key participants in the educational process, have enabled to know the aspects related to the assessment process and its implications for learning and teaching. Although results are preliminary, it is possible to state that the impact that assessment has on teaching and learning, it also impacts the future life of the students, because through it certain type of skills required in professional contexts are developed and improved. Accordingly, when students enter into the labour market they can put into practice all these skills developed through the assessment methods. Furthermore, self- and peer assessment are to be preferred in higher education, since these methods enhance learning and develop student assessment skills. Therefore, assessment influences the

process of teaching, learning and students' performance on the professional future. The findings have implications for (re)thinking the practices of assessment in Higher Education, particularly in regard to the usefulness and relevance of peer and self-assessment as well as for the connection between assessment methods and views of teaching and learning from the part of both students and university teachers.

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An Interdisciplinary 4th Level Education Model: Connected Health

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Abstract

This paper responds to the need for interdisciplinary approaches to fourth level education that better reflect the complexity of the world in which we work and conduct research. We discuss this need in technology-enabled healthcare, Connected Health. We propose a model for fourth level interdisciplinary education and discuss its trial application in two European structured PhD programmes in the Connected Health research arena. We suggest broader learning objectives for the emerging fourth level graduate, methods of incorporating multiple disciplinary inputs and perspectives into deep disciplinary PhD training, intersectoral approaches to ensure employability and impact, and innovative training methods and structures to facilitate interdisciplinary and intersectoral learning. We give some examples of innovative training modules used within the pilot programmes. Finally we discuss six core elements of a truly interdisciplinary programme at fourth level – exposure to different environments, joint supervision, a genuine role for the non academic sector, career development training and planning, the development of a sustainable training network beyond the life of the programme, and data openness.

Keywords: *Fourth Level; Interdisciplinary; Intersectoral, Models, Innovative Methods, Connected Health.*

1. Introduction: The Need for Interdisciplinarity in Connected Health (CH)

As the population aged over 60 almost doubles (U.N., 2015), healthcare costs will become unsustainable. CH offers a new health management model combining state-of-the-art technologies, tools, and methodologies. (Caulfield & Donnelly, 2013). Although 80% of EU countries have an eHealth strategy (Enject, 2016), implementation lags due to lack of evidence of effectiveness; few data management standards; privacy/security concerns; old reimbursement models; and resistance to change (Anderson, 2007; AT&T, 2012; Accenture, 2012). These challenges are poorly addressed by siloed approaches at both research and practice levels. Technology alone is not sufficient to address health needs but must be integrated “into the care and services that are delivered” (UK Dept of Health, 2011) as many Research and Development projects fail to reach market. We propose an interdisciplinary education model that encourages “professionals [to] learn with, from and about each other to improve collaboration and the quality of care” (CAIPE, 1997). We suggest broader learning objectives, and isolate the six core elements of a truly interdisciplinary programme at fourth level. This paper explores the conceptual underpinnings and development processes employed to develop two structured PhD programmes (Innovative Training Networks under EU Marie Skłodowska-Curie Actions - MSCA). These programmes were specifically designed to exploit interdisciplinarity and in so doing develop CH champions of the future. This paper introduces the concept of CH, examines the concepts underpinning the interdisciplinary CH PhD programmes and describes how interdisciplinary and intersectoral elements are employed within the PhD training and secondment programmes.

CH, as a market and as a scientific field (Swan, 2009), requires “T-shaped” individuals for its research and practice workforces (Figure 1). We must expose the next generation of CH contributors to the different contexts in which they will work. We must develop within them a new relationship with their colleagues from other disciplines – one based on understanding, trust, and confidence. We must help them to reevaluate their understanding of ‘real life’ – prioritizing their patient’s needs, and valuing what their patients can bring to the table in terms of the lived experience. Our model reflects the fact that this is best achieved through the concrete experience gained while learning ‘in context’ (Kolb, 1984). Graduates from our model programmes will ally deep disciplinary expertise (state-of-the-art theory, practice and research value in their domain) to a broad understanding of contextual domains (including business, economics, engineering) and the life, health, computer and social sciences. Such CH “champions” will together construct a new understanding of the complex, interconnected challenges across the education, industry, health, and policy sectors. This reflects the constructivist learning theory that fundamentally underpins our programme design. Students take what they already know, integrate it with a

new experience or learning, creating truly novel understandings for themselves due to the interdisciplinary context in which the learning is constructed (Ertmer & Newby, 1993).

2. The Programmes

While all MSCA programmes encourage the involvement of industry, the formalization of secondments, intersectoral approaches, and transferable skills, our programmes go beyond these criteria. They represent a genuine effort to redefine PhD education in CH. No other European CH projects involve structured PhD training (CORDIS, 2017). ENJECT (2016) finds only half of healthcare professional training programmes deal with CH, most focused on medical informatics or data analytics. No programmes span the necessary range of disciplines because of the difficulty in their inception (expertise across disciplines), delivery (structure and cohesion across disciplines), and translation (multi-sector input and application). We are creating a unique cohort of 23 “T-shaped” researchers (Figure 1). Graduates arrive with domain credibility and depth, and deepen this in their PhD project (vertical of the ‘T’). What distinguishes these programmes, however, is the horizontal capping of the ‘T’ through intersectoral learning within secondments, and interdisciplinary learning within the training programme.

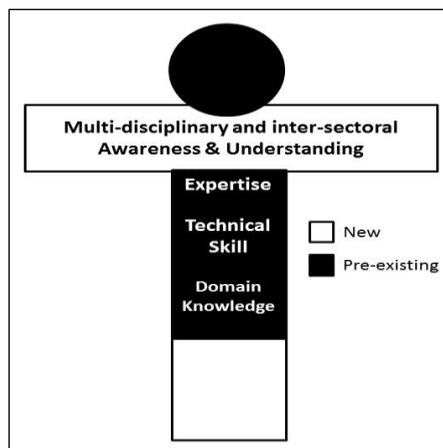


Figure 1: The “T-shaped” researcher, illustrates how students develop the traditional expertise and skill associated with PhD coupled with additional learning as part of a multi-disciplinary and intersectoral community.

The programmes are built on 6 elements: deep domain expertise (PhD project/ intersectoral secondment), broad education (introductory seminars to each discipline), research skills, integrating activities, career development, and open sharing of data. Each is designed for interdisciplinary learning with communications skills training for intersectoral and interdisciplinary communications, and career development for roles at the intersection of disciplines and sectors. Events encourage formal and informal interdisciplinary/intersectoral networking and collaboration. Modules such as the CH index, bring students together to

identify and weight multi-factorial impacts on CH adoption from varied disciplinary and professional perspectives. Concurrent workpackages promote state of the art and cross-pollinate, enabling further interdisciplinary learning as well as industry-relevance. Industry includes multi-national corporations (MNCs), small to medium sized enterprises (SMEs), hospitals and charities. Interdisciplinary programmes facilitate engagement by supporting diversity, participation, connections, and interactive teaching and learning, students report positive experiences (Newswander & Borrego, 2009).

Intersectoral secondments ensure an ability to operate in both academic and non-academic environments and broaden the researcher's networks and frame-of-reference. Professional learning develops as students role-model individuals/professionals already working within CH. The tacit learning and nuances which are only developed with exposure to the sector are strikingly evident on students' return from secondment. This situated learning reflects our belief that knowledge cannot be taught in the abstract and, to be useful, must be situated in a relevant or "authentic" context. Events are also opened up to non-programme research leaders, students, clinicians, and industries to further develop student networks, experiences, and skills. Programme websites facilitate peer-to-peer training and networking through forum and collaborative tools (see www.chessitn.eu) supported by social media training. Collaborative writing workshops (in conjunction with ENJECT) facilitate and equip students for joint publication.

2.1. CHESS (CH Early Stage Researcher Support System) www.chessitn.eu

CHESS will develop a model for the co-production of health with multi-stakeholder input, facilitating the end-to-end, interdisciplinary design of CH research programmes, pilot deployments, and evaluation techniques to increase and expedite adoption of CH models. It does this through 15 PhDs across four work packages: care, change, data and sustainability.

2.2. CATCH (Cancer: Activating Technology for CH) www.catchitn.eu

CATCH will bridge the gap between cancer survivors' depleted physical and emotional state, and their ability to return to a fully functional societal role through technology-supported physical exercise by a) understanding the nature and scale of the problem facing cancer survivors attempting to return to a full societal role, b) examining a variety of possible technology interventions, and c) investigating methods of selling and scaling these technology solutions.

3. Innovative Training Modules for Interdisciplinarity

European CH Index: CHESS will develop a CH index to track adoption. Data will be sourced, aggregated and visualised to inform key stakeholders, including patients, healthcare professionals, policy-makers and health system managers. The index will be published online and through industry and academic collaborator fora, as well as mainstream and health-specific media, thus raising awareness and adoption of CH.

Patient Pairing: Where relevant and appropriate, students will be paired with a patient who will represent and offer access to a relevant patient organisation. This will inform the PhD project, encourage patient impact and offer access to patients for dissemination.

Health Hack: A key feature of CHESS is a Health ‘Hack’ to produce a solution for a particular patient “need” within a short space of time providing an unparalleled interdisciplinary, intersectoral and translational training experience for students while encouraging a focus on impact and stakeholder engagement.

Web-based Project Pathway: Mentored by an industry leader, CATCH students will create a project pathway for technology-enabled cancer care spanning need identification through to commercialisation including tools and techniques developed throughout CATCH.

Working with Patient Populations: A hands-on workshop module brings students and patients together to identify the patient need. The active participation of patient representatives is crucial, not as mere “lectures” but as a collaborative process using User Centred Design principles (Shah & Robinson, 2007).

4. Discussion

The benefits of the programmes are twofold. Most obviously, the student creates a new and broader understanding of CH for themselves. Beyond that, however, is the benefit felt at the sectoral level as the programmes develop a new and highly skilled community of practice in CH. We discuss some of the factors affecting programme design and success.

4.1 Role of non-academic sector in the training programme

A key aspect of the programmes, is the intense involvement of the non-academic partners from the outset with the definition of the research objectives. For example, one of the employees in a digital health company created the seed of the description of a PhD project based on her own chronic health condition. The programmes boast 19 non-academic partners representing private enterprise (SME and MNC) as well as healthcare delivery. Private enterprise partners offer insights into the process of bringing a new product to market, while clinical partners provide a purchaser/end-user view and care pathway/patient experience insights. Patients and policy-makers also contribute to the delivery of such innovative, rounded, and ultimately translatable training programmes. Such collaboration is

essential to create the climate for interdisciplinary learning. Each of these individuals, however, would have originally been educated in a silo and will have preconceived perceptions of their professional role. It is essential that they learn to trust, and work together with, their patients and stakeholders to develop a new understanding of CH which will enhance their work going forward. Academics and non-academics designed the programme such that skills acquired match the employment needs of both sectors. While it is expected that academic partners take on training delivery, within these innovative programmes, non-academics are also heavily involved. They recruit and train PhDs, host site visits, run transferrable skills modules (e.g. innovating in an emerging market). In fact, one CHES industry partner, Salumedia, has taken on formal responsibility for training as a whole. While scientific modules and PhD training are managed by academia, Salumedia ensures that training is truly focused on career opportunities in the non-academic sector, as well as the academic. Secondments are hosted by industry partners who also form part of hosted student's Doctoral Studies Panel (DSP), bringing industry expertise to an academic process. Industry partners provide keynote speakers for training events such as summer schools and lead dissemination efforts to key clinical and industry audiences. Clinical partners source cohorts for studies, while patient leaders contribute to user experience training by setting real-life problems that are addressed by the students in training events. Healthcare policy-maker masterclasses round out student networks and influencing skills.

4.2 Joint supervision

A training committee (balanced by sector, discipline, gender and geography) ensures a common supervision structure while accommodating each institution's PhD structures. The DSP supports and enhances supervisor-student relationships, monitors progress of their doctoral studies, and provides advice and support. Each DSP includes a minimum of 3 members: the main supervisor (host organisation), the second supervisor (secondment host 'in the other sector'), and another academic mentor from host or collaborating institution.

4.3 Career Development

Each student works with the DSP to formulate his/her own Personal Career Development Plan. Although each host organisation can propose its own model, a template is provided and compulsory items to be included are: 1) Training Plan including formal education, acquired skills, and developed expertise; 2) Professional and Career Development Plan (PCDP) including research skills and awareness, personal effectiveness and development, team-working and leadership, ethics and social understanding, career management, communication skills, entrepreneurship and innovation; 3) Meeting Record Report. All PCDP and DSP meeting records are formally recorded throughout the programme.

4.4 Exposure of recruited researchers to different environments

Sectoral: CHESS and CATCH respond to industry requirements for researchers who can operate in an inter-disciplinary context across academia, healthcare, and other industries. Intersectoral secondments, site visits, keynote speakers, and DSPs ensure meaningful exposure to the healthcare, academic, and industry sectors. Training modules addressing key transferable skills common to all fields (e.g. inter-sectoral communications, management of IP rights, exploitation of research results, ethics, and outreach) maximise students' ability to exploit these exposures for career, research, and innovation purposes.

Disciplinary: Introductory modules during the orientation conference (disciplinary 101's such as "An introduction to business models" or "An introduction to health science") expose students to a range of disciplinary approaches and recreate the discipline's research environment to ensure understanding and therefore communication across disciplines.

Geographic: With up to 8 countries in each consortium including multi-national partners, students gain exposure to multiple research and commercial approaches that may be shaped by geography. Summer schools held in different countries include local site visits and keynote speakers showcasing different cultures, lifestyles and experiences.

4.5 Formation of sustainable Training Networks:

Both programmes create training networks that span geographies, disciplines and sectors with events and networks spilling into other fourth level programmes run by consortia partners. They improve the personal and career development of students beyond graduation, and networks will exist long after programme funding has ceased through future projects, funding applications and other European training programs such as COST, and more.

4.6 Data Openness:

Both programmes are part of the European Data Pilot. Students are trained on new approaches to foster the sharing and openness of research data.

5. Conclusion

The complex challenges facing society, including those of sustainable, equitable healthcare, mean that there is a need for a different kind of PhD graduate. This need is best summarised as a "T-shaped" graduate with deep disciplinary expertise allied to an ability to understand and add value in an interdisciplinary world. New, structured PhD training programmes are required in order to deliver on this agenda. They must be interdisciplinary, intersectoral and innovative in both their design and delivery. Such programmes must include new kinds of modules that offer hands-on exposure to real world interdisciplinary challenges, encourage intersectoral communication, and offer routes to industry and societal impact. Both training programmes presented here speak to the necessity of integrating the patient into the

development of health technologies. The emphasis placed on the patient throughout the programmes shows how the patient should be viewed, as core informants and educators.

We have not, as yet, attempted to transfer learnings or structures from these programmes into non-health related areas. It may well be that our success in integrating disciplines and sectors depends on an evident public good goal, such as that of sustainable healthcare. It should be noted that the dual requirements of depth and breadth place a greater burden on the student. This is offset by increased training and support structures, but we are nevertheless aware of the need to constantly monitor students for over-load or burnout.

Truly interdisciplinary programmes at fourth level will incorporate six core elements: exposure to different environments, joint supervision, a genuine role for the non-academic sector, career development training and planning, data openness, and the development of a sustainable training network beyond the life of the programme. We expect this type of programme to become more ubiquitous across Europe as funders, employers and indeed, students themselves, expect more rounded and practice-focused training experiences.

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The Role of Coherent Research-Based Curricular Unit in Mediating Students' Integrated Vision of Human Impact on the Environment

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Abstract

The ongoing development of the high school ecology curricular unit presented in this proposal is a response to the new tide of educational reforms in the United States. This curricular unit represents an attempt to frame K-12 science curriculum around three dimensions: crosscutting concepts, disciplinary core ideas and scientific practices recently released in the report on a Framework for New K-12 Science Education (National Research Council, 2012). Integration of three dimensions into the development of agriculture-related curricular unit reflects complexity and logic inherent in science education facilitating deeper conceptual understanding. The development of this curricular unit takes place under the initiative of the National Science Foundation (NSF) funded project and explores the efficacy of the agriculture-related unit on students' integrated vision of the human impact on natural systems. Research project seeks to recognize the characteristics that identify research-based curriculum (Clements, 2007). The interdisciplinary nature of this project has the potential to investigate how close adherence to features identifying research-based curriculum can support the development of coherent curricular unit mediating students' integrated vision of environmental issues. Mediation results of this nature have larger implications on future efficacy studies of curriculum intervention.

Keywords: *Crosscutting concepts; constructivism; coherence; 'educativeness'; curriculum; environmental issues*

1. Introduction

The ongoing development of the curricular unit presented in this proposal is a response to the demand of framing K-12 science curriculum around multiple dimensions recently released in the report on a *Framework for New K-12 Science Education* (National Research Council [NRC], 2012), which served as a foundation for the development of *Next Generation Science Standards (NGSS)*; NGSS Lead States, 2013). Human impact on natural systems is a section in the NRC *Framework* that includes examples of social systems that reflect the influence of human actions on the environment and require evidence-based decision-making in reducing the adverse effects of poor management of the limited planetary resources (NRC, 2012). The impact of intensive agriculture on the environment provides a relevant example of human-induced influence on natural systems communicated in current educational reforms and a real-life context to investigate mechanism underlying this interference. In this proposal we intend to explore critical features identifying agriculture-related research-based curriculum that informs connected scientifically based vision of environmental problems among high school students.

There is a pressing need to move from the ideology of constructivism to the development of research-based curriculum materials that are grounded in constructivist learning and are tightly aligned with three dimensions outlined in current educational reforms. The ongoing collaboration between the researcher and the high school biology teacher concentrates on the development of the coherent curricular unit to test correlation between critical features of research-based curriculum and students' integrated scientifically based vision of the agricultural impact on the environment as a result of curriculum implementation in spring, 2017.

2. Critical Features Identifying Research-Based Curriculum

The growing urgency for evidence-based curricular materials and the new wave of educational reforms emphasizing the integration of various dimensions of standards pose a challenge for addressing characteristics that identify research-based curriculum (Clements, 2007; DeBarger et al., 2016). Adherence to these characteristics takes into account main general principles inherent in the framework proposed for the construction of research-based curriculum in science education and mediates integrated understanding of the phenomena among students (Clements, 2007; Taylor et al., 2015). Current research proposal recognizes constructivism, coherence, and 'educativeness' as three characteristics identifying research-based curriculum (Taylor et al., 2015).

2.1. Adherence to Constructivism

With the release of the new *Framework for K-12 Science Education* (NRC, 2012) and the *Next Generation Science Standards* (NGSS; NGSS Lead States, 2013) came the need to integrate three dimensions from NGSS: disciplinary core ideas, crosscutting concepts, and scientific practices (DeBarger et al., 2016; Taylor et al., 2015). Researchers identify the unpacking of three dimensions of NGSS as the principal step in developing curriculum grounded in constructivist learning that reflects an expert view of how scientific ideas should be organized when using science standards as guidelines (Clements, 2007; DeBarger et al., 2016; Krajcik et al., 2008; Taylor et al., 2015).

Recent re-emphasis in cognitive psychology on the active role students play in constructing knowledge individually and by interacting with social community has spawned a renewed interest toward constructivism and its potential in contributing to the process of curriculum development (Osborne, 1996). Constructivist learning employs strategies attending to general epistemology of knowledge construction, grounded in the empirically-based model of students' thinking (Clements, 2002; Sandoval & Reiser, 2004). Despite the valuable contribution of constructivism to curriculum theory and practice, it can only be utilized to its full potential under ideal educational circumstances (Osborne, 1996; Terwel, 1999). Instructional models based on constructivist learning assist teachers in scaffolding learning activities for students and creating ideal educational opportunities for meaningful learning to occur (Krajcik et al., 2008; Taylor et al., 2015).

2.2. Adherence to Coherence

In promoting coherence curriculum developers arrange learning activities within coherent conceptual framework that reflects the logic of the science discipline from which the subject matter derives (Schmidt et al., 2005; Taylor et al., 2015). Development of conceptual framework is a principal step in ensuring coherent flow of discipline specific scientific ideas consistent with constructivist learning (Taylor et al., 2015). Adherence to conceptual framework becomes instrumental in integrating disciplinary core ideas highlighted by NGSS and in coordinating learning goals, cognitive tasks and assessments. One of the ways of strengthening coherence of the curriculum development process is the use of conceptual flow graphics (CFGs) (Taylor et al., 2015). Curriculum developers use CFGs to overlay a constructively arranged sequence of cognitive tasks with disciplinary core ideas creating conceptual storyline (Fig. 1).

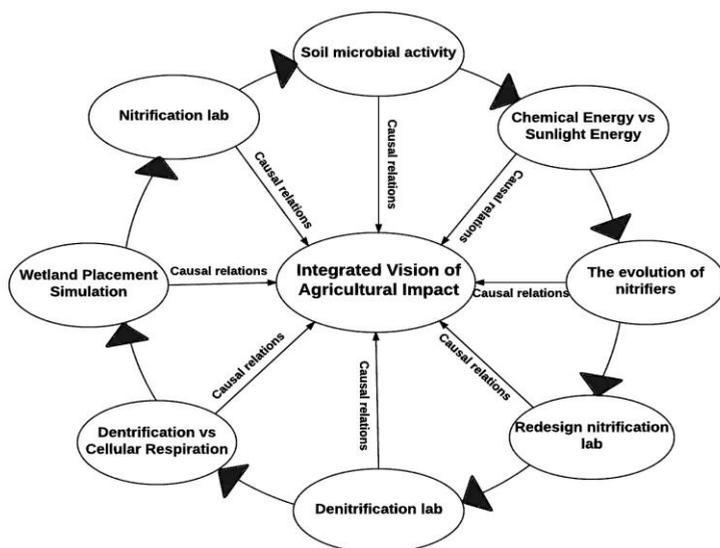


Figure 1. Conceptual Flow Graphic (CFG) of the activities in the curricular unit advancing the crosscutting concept by exploring causal relations

2.3. Adherence to ‘Educativeness’ of Curriculum Materials

To ground the discussion on ‘educativeness’ of curriculum materials, we will focus on the explicit teacher support for learning, such as pedagogical support, which is embedded in the curricular materials (Schneider & Krajcik, 2002; Taylor et al., 2015). Current research points to the imminent tension arising as a result of having to incorporate particular curriculum without clear pedagogical support (Krajcik et al., 2008; Taylor et al., 2015). To mitigate this tension, researchers list suggestions in the format of heuristics serving the purpose of supporting teachers as they implement the curriculum materials as intended (Davis & Krajcik, 2005).

These heuristics promote ‘educativeness’ of curricular materials by providing specific content, skills, topics, suggestive timeline, a pedagogical model as well as instructional strategies on dealing with potential student misunderstanding (Remillard, 1999; Schneider & Krajcik, 2002; Taylor et al., 2015). To that extent educative materials provide teachers with pedagogical support by including help in understanding the sequence and flow of the curricular materials (Schneider & Krajcik, 2002).

3. Carving the Space for Collaboration

Despite the clear advantages of educative curricular materials, professional development and collaboration provide opportunity for teachers to study materials thus increasing teachers' knowledge of the rationale underlying instructional decisions embedded in the curricular materials (Taylor et al., 2015). The need for professional development or collaborative learning opportunities becomes critical when curricular units include the use of computer-based simulation (Webb, 2005). To avoid teachers' withdrawal from their teaching roles and overreliance on the software simulation, teachers need to engage in questioning students to assess their understanding of the simulation use (Sandoval & Reiser, 2004; Webb, 2005). Development work with teachers promotes higher level of engagement, which leads to frequent interactions with simulation and teachers' improved ability to design tasks and questions that would promote student thinking (Webb, 2005). Therefore, professional development and collaborative learning with the curriculum developers carve the space for teachers to interact with the educative nature of curricular materials and to take full advantage of research-based curriculum materials. These collaborative learning opportunities and educative provisions should account for potential difficulties that teachers face when adapting curriculum materials into their existing curricular repertoire (Davis & Krajcik, 2005; Remillard, 1999).

4. Attendance to Critical Features During the Development of Agriculture-Related Unit

The agriculture-related curricular unit presented in this paper coordinates learning goals, cognitive tasks and assessments around NGSS dimensions and exemplifies a tension between social system and the environment (NRC, 2012). The significance of sound understanding of environmental problems becomes central for citizen participation in addressing issues stemming from human interference with natural systems (Mohan et al., 2009; Gunckel et al., 2012). Therefore, in order to gain agency in evidence-based decision-making on environment-related issues from a scientific perspective, students need to develop understanding of causal relationships among entities implicated in the negative impact of the agricultural production on ecological systems (Gunckel et al., 2012; Williamson, 2011).

4.1. Research-Based Unit Consistent with Constructivist Learning

As a part of the NSF sponsored research project, the proposed agriculture-related curricular unit stems from the collaborative efforts between the researcher and the high school biology teacher whose ecology class will participate in the unit implementation in spring semester 2017. In attending to constructivist learning during the development of the curricular materials, central curricular components are framed within the 5E Instructional Model

(engage, explore, explain, elaborate, and evaluate) (Taylor et al., 2015). Consistent with the principles of constructivism, the initial learning activity serves the purpose of anchoring students' interest. Throughout the sequence of following cognitive tasks students can isolate causal relationships by applying the canonical strategy of controlling variables and eliciting general epistemological commitments of constructivism that are reflected in the crosscutting concept of cause and effect in NGSS (Sandoval & Reiser, 2004).

4.2. Coherent Storyline in Research-Based Unit

Although general epistemological commitments are consistent with principles of constructivism, they lack the knowledge on what particular discipline specific variables to control (Sandoval & Reiser, 2004). Cognitive tasks of this unit intend to overlay crosscutting concepts of cause and effect with disciplinary core idea of agricultural impact and contribute to the overall coherence reflected in the curricular unit. The overarching goal of the curricular unit aims to emphasize causal relations among entities implicated in the agricultural impact on the environment. As a result of this coherent curricular sequence, ecology high school students establish evidence-based causal relations among entities in mapping out connection between nitrogen and carbon cycles as a mechanism implicated in the impact of intensive agriculture on ecological systems (Mohan et al., 2009; Gunckel et al., 2012; Williamson, 2011). Such an approach intends to facilitate students' understanding of lower level activities and encourage students to use causal relations to construct evidence-based explanation about higher-level observable phenomenon (Williamson, 2011). By unraveling discipline specific causal relationships students establish the link between invisible micro processes and observable patterns at macro-scale, and mediate integrated understanding of feedback mechanisms bringing natural systems back to stability (Fig.1).

4.3. Educative Curricular Materials and Collaboration Lead to Enhanced Pedagogical support

The ongoing collaboration between the high school biology teacher and the researcher has been critical in helping the teacher develop more content specific knowledge on ecological concepts that the teacher previously considered outside of her expertise area. This collaborative experience provided the teacher with opportunities to study the materials and to make instructional decisions regarding the arrangement of the cognitive tasks, instilling the teacher with the sense of ownership of the curriculum materials that will be implemented in spring 2017 (Davis & Krajcik, 2005; Schneider & Krajcik, 2002).

The critical importance of collaboration between the teacher and the researcher has been especially pronounced during the collaborative development of questions and tasks to accompany a software simulation exploring the effectiveness of wetland construction. This

computer-based simulation results from the partnership between U-spatial software engineers and St. Anthony Falls Laboratory at the University of Minnesota. Research indicates the advantage of using computer-based simulations in manipulating variables that are outside of user's control in the natural world (Huppert et al., 2002; Trey & Khan, 2008). To such extent the use of this computer simulation intends to promote students' sense of agency in implementing the best land use management practices. At the same time, the effective use of computer simulation is closely connected to the teacher guidance that supports the simulation use (Sandoval & Reiser, 2004; Webb, 2005). The ongoing collaboration with an active involvement of an expert scientist aims to develop a set of questions and tasks to facilitate students' ability in constructing explanations on wetland effectiveness by eliciting evidence-based causal links highlighted throughout the curricular sequence. These collaborative learning opportunities with curriculum developers enable the teacher to capitalize on the embedded educative nature of the unit materials and to participate in the development of cognitive tasks that encourage evidence-based vision of environmental issues.

5. Significance

This research project intends to explore the extent to which synergistic arrangement of cognitive tasks in the research-based curricular unit strengthened by pedagogical support and collaborative opportunities assists teachers with mediating integrated students' vision of human-induced impact on the environment. The uniqueness of this study stems from testing the impact of coherent agriculture-related curricular unit encouraging students to explore causal links among entities in mapping out the interactive nature of nutrient cycles underlying the human interference with natural systems. The interdisciplinary nature of this project has the potential to show how close adherence to features identifying research-based curriculum and collaborative learning opportunities can support development of coherent curricular unit mediating students' integrated vision of environmental issues. Having coherent curriculum materials consistent with educational reforms and a teacher prepared to use these materials in an intended manner are critical in enacting opportunities that mediate considerable impact on students' conceptual understanding. Mediation results of this nature have larger implications on future efficacy studies of curriculum intervention.

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“Walking a tight rope”- a risky narrative of transition to University

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Abstract

The study of the transition of young people to university necessarily confronts the semi-dependency of the lives of contemporary youth: on the one hand they remain largely economically dependent and on the other they are becoming socially independent. We therefore seek to illuminate engagement with learning as situated in the midst of semi-dependency typical of adolescence, at a time in the life-cycle when typically young people experience a strong “pull” to socialise with peers, but have not yet become fully economically and socially adult. The paper examines the consequences of this contradiction on students’ transition to university, from the subjective experience of students as they transition to university. We suggest disengagement and even drop out from studies can arise from a contradiction between the students’ social and study (economic) domains. The dependency is not only economic, but is culturally mediated and may therefore be experienced by some students in more acute forms. Cultural aspirations and family expectations and ties can provide the impetus to succeed and so overcome the emotional challenges encountered, and these ties may help them walk a tight rope to success. Finally, we explore the consequences for policy and practice.

Keywords: Higher Education; Drop Out; Student Experiences; Transition; Learner Identity.

1. Introduction

Many students look forward to the move to University and have expectations of increased social independence, but this may not be so easy to negotiate once there (e.g. McInnis, 1995; Briggs *et al.*, 2016; Tett *et al.*, 2016; McGhie, 2016). This pattern mirrors the transition to secondary school, when most children indicate considerable anxieties about their forthcoming change, but also often positive anticipations about the new opportunities (Anderson *et al.*, 2000; Lucey & Reay, 2000; Hernandez-Martinez & Williams, 2013). Our own data on transition to university also suggests this, with students expressing excitement as well as anxiety about moving to University. The first year of University is associated with high drop out rates, non-attendance and lurking, which prove problematic across the Western World (McInnis, 2001, Kantantis, 2009). Indeed, in the U.K. support for the first year experience has been given prominence in a drive to improve retention rates (Palmer *et al.*, 2009).

The changing lives of contemporary young adults has been conceptualised as a period of extended transition to adulthood (e.g. Ahier & Moore, 1999; Arnett 2000, 2004; Brynner, 2005; Hall *et al.*, 1999; Jones and Wallace, 1992). This has given rise to the use of new labels or social identities, such as “emerging adult” or “extended adolescent”. For example, Arnett (2004) describes ‘emerging adults’ as being particularly skilled at maintaining contradictory emotions; ‘they are confident while still being wary and optimistic in the face of large degrees of uncertainty’. Although, we note that Brynner (2005) offers a note of caution to a normative reading of “emergent adult” and reminds us that youth transition comes in various modes, including both new and traditional kinds of social identity.

Emerging adulthood is grounded in the relatively new phenomona of young people living for an extended period of time economically dependent yet socially independent lives. Ahier and Moores (1999) point out that “*the situation today is seen as a consequence of major changes in those areas (work and family), which had previously remained stable. The impact of these changes is further amplified by factors such as the expansion of higher education and changes in the benefit system; all of which combine to make the situation of youth far less secure, less predictable and structured, and enforcing a much more protracted period of ambiguous dependency*’ (p516).

This paper considers students’ learner identities at a time when many experience a marked shift in social freedom as they move away from home, whilst remaining dependent, or at least semi-dependent, on their families for economic support. We are particularly concerned here with how students experience social and academic transition, and how these interact. We suggest that a marked disconnection between students’ “emergent adult” inflexed learner identities and the institutional and pedagogic norms typically encountered within Higher Education Institutes can sometimes lead to student disengagement or drop-out. We

therefore seek to illuminate engagement with learning as situated in the midst of semi-dependency typical of adolescence (Kantantis, 2009; McInnis, 1995). This is a time in the life-cycle when typically young people experience a strong “pull” to socialise with peers, but have not yet become fully economically and socially adult. We argue, like Yorke (2000) that understanding the transition to adulthood as *interwoven* with the transition to higher education has the potential to offer solutions to smooth the transition into Higher Education.

2. Methodology

This paper reports on the work of the United Kingdom’s Economic and Social Research Council (ESRC) funded research project “*Mathematics learning, identity and educational practice: the transition into Higher Education*” no. RES-062-23-1213. This project builds on our previous work “*Keeping Open the Door to Mathematically Demanding Programmes in Further and Higher Education*” no. RES-139-25-0241. As part of this research project, interviews with 80+ students, captured individual students' educational-life stories as they progressed through college-university transition and mainly into STEM degrees.

Interviews were conducted either in the summer prior to going to university, when students talked about their expectations (40 interviews), or during the first three weeks of term (40 interviews). The same group of students were interviewed again between 5 and 6 months after the start of the academic year (70 interviews). Interviews were semi-structured, lasted approximately thirty minutes and were either conducted face to face or by telephone.

The narrative analysis revealed four narratives of transition. There was a broad and readily identifiable narrative of being a student who moves away from home and has to balance a tight rope of social and academic demands. We called this narrative “*walking a tight rope*”. Three other narratives of transition were highlighted with regard to university students who remain in the family home: “*live-at-home-as-savvy*”, “*stay-at-home-as-gender-ethnicity-preference*” and “*worker student*”. However, discussion of these three other narratives is beyond the scope of this paper in which the focus is the “*tight rope*” narrative. The “*walking a tight rope*” narrative was chosen because it resonated in the stories of many of the students who were young and had moved away from home as a traditional right of passage. Although universities have a diversity of students, the traditional move away to university following “A” Levels remains a significant passage to university and into young adulthood.

The analysis presented in the remainder of this paper focuses on students who are young adults moving away from home for the first time, those who by definition experience a

marked shift in their social freedom as they begin university. It is within this group where we would expect to find most noticeably tensions between strong emergent adult identities and University pedagogic cultures. If *emerging adult* is worthy of the status of a new social identity then it is in social transitions such as the mass movement to live away from home on campus or in other university associated accommodation, where we would expect to find it, and so provide the conditions from which emerging-adult-student learner identities might be expected to occur.

For the purpose of this paper the analysis is illustrated with references to one student studying Mechanic Engineering, who we call Hamid. His case was chosen as a typical example of a student with good entry grades, enthusiasm for going to University and familial support. We suggest the sense of ordinariness in his talk (Rosenwald and Ochberg, 1992) in Hamid's story about playing strategic games with his degree provides an important insight into the complexities of being a university student. Hamid sees himself as on his own with his books from which he is pulled away by his peers, but also fear of letting down his family kicks in and spurs him on to do enough to survive academically, to do enough but not too much more than necessary. While there are aspects in the detail of the substantiation of Hamid's story that may reflect his gendered and ethiced being, his narrative was typical of many of the students we interviewed, regardless of their gender or their ethnic heritages. We suggest that this narrative, which we called "*walking the tight rope*" may offer insight into understandings of some students' disengagement with learning and sometimes drop out as they transition to university.

3. Emergent Adults hit University

Moving away from the family home to university sets up a changing relation with the socioeconomic basis of society - as socially independent yet economically dependent young people who are legally adult. When many students of a similar age move away from home in order to attend university, we witness a societal level mass movement to university, which creates a shift towards social independence for a significant proportion of the population. As is the case for many students it was the move out of the family home, which supplied Hamid with an injection of a rapid change in social independence. In this way, the social identity of a university student is transitional, en-route to adulthood, and as such falls between child (socially and economically dependent) and adult (socially and economically independent). Students talked about experiencing a troubling tension between a desire to socialise and the demands of study "*Yeah that sort of, that sort of feeling like I went out last night and didn't do my work and I'm now worrying about it now.*" "*You know, .. the problem with me is I'm, I'm scared of the freedom of not being able to do no work, well, erm, erm make me lazy again*" (Hamid). Our reading of the interviews, typified in

Hamid's account as an example *generic* of many of the students interviewed was to conclude that there can be an almost unbearable tension between the pull of the social in late adolescence/emerging adulthood and newbie university students' experiences of academic learning as a relatively isolated, autonomous activity. The social pull to fit in and establish and maintain relationships is, as Palmer *et al* (2009) pointed out, critical to students' sense of well-being as they transitioned into university. Hamid's eagerness to be social is highlighted here, "*I need to get out of it [room in Hall of Residence]. Once I'm in that room and I've done my work, I just wanna get out of that room and go.*" (Hamid).

Our data tells of the student who rolls late out of bed after a night out, or who studies through the night to complete an assignment that needs to be handed in the next day: these are well recognised scenarios, even to the extent of having become cultural models that teachers and others often used to renege students. However, academic laziness comes with a conscience and often a sense of guilt. Hamid's case presents a typical (partially) alienated learner, whose push to study is for the much part driven by cultural affinity and family influences, as well as by career and/or lifestyle aspirations, but who is pulled away by the immediacy of the desire to socialise with his peers. For example, six months into university an image of having to look his parents in the eye and tell them he had failed the year became a powerful resource for Hamid: "*The thing that scares me is not passing this year. That's what scares me, cos I've never failed anything in my life....At the moment I think I'll pass, but it's like I said, I think in a couple of areas it'll be quite lucky I think, but cos, you see, I've never failed anything before you can, I couldn't look in my parent's eyes and say...*"

Hamid acknowledges he has a deal with his family, which he needs to uphold, or else risk threatening his identity as a respected and successful community and family member. This threat to his designated identity to instead be seen as someone who can't be trusted and messes around provides Hamid with a motive to knuckle down and prepare for impending end of year examinations:

H: Oh yeah, they're supporting me, oh yeah. But like I said, if I'd moved out one hundred and thirty miles away from home, not to fail a year. If I fail this year, they're gonna think, 'what are you doing? What have you been doing instead of doing your work'? You know, cos they're just thinking right you do your work before you go out, obviously to your parents 'I'll do it yeah don't worry'. But you know obviously it's different cos they can't keep an eye on me out here, so it's different, but I keep my end up, and they'll keep their end up, innit. If I keep working hard, keep doing my work, keep passing my years, I won't have my parents on my back about it, do you see what I mean?

In choosing to case study Hamid and illustrate this scenario, we aim to provide sufficient detail to problematise this "walking the tight rope" learner identity, and offer an alternative

perspective to the more simplistic “lazy student” response. That Hamid scores highly in cultural, social and educational capital and self-identifies as a resilient learner with good entry grades, and so would not usually be counted as “at risk”, we believe makes the argument all the more poignant. Rather than confining Hamid to “lazy student”, we suggest instead that living out his learner narrative is hard work because it requires on going identity negotiation to maintain a consistent self in the face of fundamental and on-going dissonance, a dissonance that arises in part because of his new found freedom, socially at a time in his life when the need for sociality can be experienced especially acutely.

“Still haven't got used to it yet. But no I'm starting to knuckle down now, it's end of year exams soon and all the modules are starting to come to an end....A big difference, a big, big difference. Obviously, the education's a step higher but also what's expected of you is a step higher as in you know, make sure you allow yourself enough sleep before the next lesson, make sure you come into lessons on time, coursework hand in dates. You know, all these things are quite obvious, but its easier said than done.” (Hamid).

Yet Hamid's fear of letting down his family (his semi-dependent proxy for his economic domain) gave him the impetus to study hard as the time of his exams approached. In our study, rather than the hard economic dependency on the family, it was cultural and aspirational ties that acted to fuel a trajectory of success.

4. Pedagogy in HE

Hamid stated that he hasn't found the support he feels he needs either in or outside lectures: in contrast with his pre-university course, large class sizes at university were sometimes experienced as intimidating and posed a barrier to asking questions, *sometimes with a class of fifty to sixty people it's very intimidating to put you hand up, because especially if you're thinking those other fifty to sixty people understand it and you don't*. Hamid says that he finds university lecturers not so approachable. *I find sometimes the teachers they get a bit angry I suppose sometimes. If you don't understand certain concepts or you ask them this question they kind of look at you like “have you been listening to me for the past....”, & which I have been listening to them but I still don't understand*. He contests this, positing a view that lecturers ought to be approachable and by implication sociable. Hamid commented that were he a teacher he would *‘aim to be a very friendly teacher in respect that, “I'm here to help you.”*

Hamid's account reflects a common “troubling” experienced by many students in our sample as they transitioned into university learning: the social relationships they had developed with their previous teachers were no more, and at the same time, the immediacy of access to the teacher had become a step removed and needed negotiation. For example,

another student revealed, *'it's not like there's a relationship between the lecturer so if you're like, slacking off they're not going to be like "oh work harder" then'*. Harris & Pampaka (2016) identified the lecture as a barrier to learning as students transition to Higher Education. In addition, there was wide expectation that university students learn independently i.e. to learn to take notes, to learn from text books and revise on their own: independent learning for many meant "learning on your own", with relatively little access to support outside formal teaching hours. By the time of the 2nd interview, some students were part of informal critical friends learning groups, which had "emerged" and belonging was claimed to help understanding, serving also as a social space promoting bonding. Hamid, like most of his immediate peers, was, however, less keen about learning with friends. He explained this by drawing on a model of teacher as expert, making the point that when he works with his friends they do not always know whether they are tackling problems correctly. In addition, Hamid spoke of his successful route to learning prior to university as being a type of social engagement with the teacher in a relationship which he nostalgically misses, contrasting this with his sense of anonymity as a student at university.

Hamid's model of "teacher-as-expert" mediated his learning approach at university by acting to keep his social and academic spheres distinct and so positions "independent learning" to mean learning on his own. We conclude from this that for Hamid, who acutely experiences this commonly voiced tension, the "teacher-as-expert" model needs challenging to enable the development of a pedagogy for academic learning that is social in construction. We argue that this will require the development of a pedagogy that merges the social and academic domains of students, using a social rather than traditionally transmissionist pedagogy.

5. Conclusion

The transition to university can give an impetus towards social independence that is challenging to manage for the young person leaving home for the first time. This transition may lead to a separation of the social from the academic arena because higher education pedagogy often uses transmission learning approaches. An inherent need for sociality then may become a major factor in a student's academic adjustment, which if not managed appropriately can lead to disengagement or even drop out. We suggest that this arises from a shift in the students' locus of control in their social and study (economic) domains. Cultural aspirations and family expectations and ties can provide the impetus to succeed and so overcome the emotional challenges encountered and these ties may help them walk a tight rope to success. Yet, when the social is removed from pedagogy the learner identities that result can be more opportune, promoting surface rather than deep learning.

The study of the transition of young people to university necessarily confronts the semi-dependency of the lives of contemporary youth. Our study demonstrated a contradiction at play for the student who becomes largely socially independent but remains economically dependent on their family. The contradiction is, however, not only economically mediated, but is culturally mediated and may therefore be experienced by some students in more acute forms. Sometimes the economic or cultural dependency can act against eventual drop out. Indeed, our interpretation placed greater weight on the cultural mediation than the hard sense of economic of Ahier and Moores (1999).

The implication of this is to encourage universities to consider the imperative of developing a more social pedagogy by recognising more fully the inherent sociality of human beings and their learning. We suggest that a social pedagogy has the capacity to engender a deeper engagement in learning and so help strengthen students learning identities and depth of participation. The quality of the learner identities we engender in our students is paramount (*see also Briggs et al, op cit.*). Unless we confront a more social pedagogy, we can expect that a do enough to get by learner identity may continue to pose a risk.

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Internal determinants of university student employability.

Construction and validation of scales

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Abstract

One of the challenges faced by European universities today is to ensure that their graduates find employment in line with their attributes. Graduate employability depends, among other factors, on many internal determinants in individuals. However, there is no consensus on how to measure them, and the scales developed to date have not been properly validated. The purpose of this paper is to construct and validate, at confirmatory level, a set of instruments for measuring the internal determinants of graduate employability. The results, based on a sample of 816 students, show the structure of the scales resulting from checking content validity, dimensionality, reliability, and convergent, discriminant and nomological validity.

Keywords: *employability, internal determinants, university, scales, psychometric properties.*

1. Introduction

Internal determinants of employability can differentiate graduates and make them more employable, preventing them from facing the dilemma of an unsuitable job or none at all. There have been few studies on the internal determinants of employability, with most of them considering just one determinant, and just a few considering several internal determinants together (Chou and Shen, 2012; Dacre and Sewell, 2007; Dacre et al., 2014). Moreover, regarding scales for measuring such determinants, very few of them use confirmatory tests for validation and, when they do, they do not perform a full analysis of their psychometric properties (e.g. Dacre et al., 2014), or their samples are small (e.g. De Guzmán and Choi, 2013; Yusof et al., 2012).

This study proposes a set of scales that have been validated at confirmatory level for measuring the internal determinants of employability. It has several strengths. From a theoretical point of view, it presents an updated review of the literature on the internal determinants of employability and scales for measuring them. From an empirical point of view, the following scales have been validated at confirmatory level, translated and/or adapted from prior research on the internal determinants of employability – self-confidence, ambition, competencies, training and self-efficacy for job searching.

The paper is structured as follows. After this introduction, we describe the theoretical framework for the internal determinants of employability. We then explain the methodology followed, and develop and validate the measurement scales. Finally, we draw conclusions.

2. Theoretical background

Based on the review of the literature, in this study employability is considered as the capacity for obtaining and keeping a job or obtaining a new one if required (Hillage and Pollard, 1998). However, a more thorough definition considers that there are certain external or contextual and internal determinants that affect it (Hernández-Fernaund et al., 2011; Hillage and Pollard, 1998; Gamboa et al., 2007; Rothwell et al, 2008; Rothwell et al., 2009; Tymon, 2013) and which should therefore be considered when explaining employability (Fugate et al., 2004).

Although employability and its factors have received considerable attention in the literature (Dacre et al., 2014), as stated by Finch et al. (2013: 682), “much of the research into employability factors is theoretical”.

Internal determinants refer to the perception that individuals have on themselves, that is, on their internal attributes (Rothwell et al., 2008). In this research we consider self-confidence,

ambition, skills, training and self-efficacy for job searching. All of these have been shown to be key components in the development of employability (Dacre et al., 2014; Dacre and Sewell, 2007), but most of them have not been used together in the literature. Most of the studies use a single internal variable.

Self-confidence. Self-confidence refers to the way in which individuals project their capacities and abilities in their environment and use them successfully when searching for and obtaining a job (Dacre and Sewell, 2007; Rothwell et al., 2008; Rothwell et al., 2009; Wittekind et al., 2010).

Ambition. Ambition measures individuals' perception of success for a future career or for future job searching (Rothwell et al., 2009). Rothwell et al. (2008) state that ambition affects the perception of employability because the fact that students are not yet workers explains why ambition is a necessary indicator of the perception of success in the future.

Competencies. Competencies cover the knowledge, values, attitudes, abilities and skills needed to obtain, keep and perform well in a job (Conchado and Carot, 2013; De Guzman and Choi, 2013). In today's society, graduates have to have the skills required by employers (Freire et al., 2011; Suárez, 2014). Since this research covers students from all fields of study, we focus only on general competencies. These are the ones that are in most demand from employers because they complement the specific competencies covered by the course of study (Freire et al., 2011).

Training. Training refers to academic performance, that is, the results and grades obtained by students and their satisfaction with them (Dacre et al., 2014; Rothwell et al., 2008), as well as their future commitment to acquire greater knowledge (Van der Heijde and Van der Heijden, 2006). Both academic performance (Dacre et al., 2014; Hillage and Pollard, 1998; Rothwell et al., 2008) and continuous learning and improved learning (Van der Heijde and Van der Heijden, 2006) are considered in studies of graduate employability (Dacre and Sewell, 2007; Rothwell et al., 2008, 2009) and workers' career development (Rothwell and Arnold, 2007).

Self-efficacy for job searching. Finally, self-efficacy for job searching refers to the individual's confidence and motivation in a specific situation, such as job searching (Chou and Shen, 2012; Dacre and Sewell, 2007; Hernández-Fernaud et al., 2011; Van der Heijde and Van der Heijden, 2006). Some authors conclude that it is a good predictor of success (Wittekind et al., 2010), especially for students (Chou and Shen, 2012).

3. Methodology

The population studied was made up of 6,242 students registered during the 2014-2015 academic year in the last year of a graduate course at a Spanish university. A probabilistic method with proportional stratification was used to select the sample, considering the stratification variable to be the percentage of last-year students registered in this university in each of the five fields of study laid down by the Spanish Ministry of Education, Culture and Sport, that is, Arts and Humanities, Science, Social and Legal Science, Engineering and Architecture, and Health Science. The information was compiled between April and June 2015 from personal interviews. The final sample, after data cleansing – processing of missing values, analysis of outliers and normality tests – amounted to 816 students, representing a response rate of 13.07%.

4. Scales of measurement

4.1. Generation of items

In order to build a valid tool for measuring each of the internal determinants of employability, a thorough review of the specific literature was performed. The initial proposal for the number of items for each variable and the studies on which they are based is given in Table 1. All the variables were rated using 7-point Likert scales. A sample of the items of each variable is: self-confidence, “*I believe I could hold any job providing that my skills and experience are needed for it*”; ambition, “*I believe it is urgent for me to progress in my career*”; competencies, “*I can convince others of my worth*”; training, “*I am satisfied with my academic performance so far*”; self-efficacy for job searching, “*I know where to find information about the jobs I am interested in*” and employability, “*I am sure I shall find work easily if I start looking*”.

Table 1. Proposal for scales to measure the internal determinants of employability

Variable (number of items)	Author(s)
Self-confidence (7 items)	Rothwell et al. (2008)
Ambition (5 items)	Rothwell et al. (2008)
Competencies (34 items)	Andrews and Higson (2008), Conchado and Carot (2013) and Dacre et al. (2014)
Training (8 items)	Rothwell et al. (2008)
Self-efficacy for job searching (13 items)	Dacre et al. (2014) and Hernández-Fernaud et al. (2011)
Employability (3 items)	Wittekind et al. (2010)

Transcultural adaptation of the items was then performed (Más and Escribá, 1998; Ros-Morente et al., 2011), with conceptual rather than literal translation (Gutiérrez et al., 2007) and adaptation to the culture and routine of the respondents (Mirtea et al., 2008). This selection was then reviewed critically by five experts in higher education.

4.2. Validation of the measurement scales

We validated the scales proposed by analysing their psychometric properties, that is, content validity, unidimensionality, reliability and convergent, discriminant and nomological validity.

The content validity of the scales was guaranteed as follows: (1) by identifying the items and dimensions for each of them based on a thorough review of the literature; (2) by having the appropriateness, adaptation and/or translation of the items and dimensions checked by a group of experts, and (3) by guaranteeing, during the process of re-specification of the measurement models, that the items remaining in the model conceptually covered the full extent of each variable.

To study the unidimensionality of the scales, a exploratory factor analysis (EFA) was carried out. Previously, we considered whether factor analysis was appropriate for analysing the data. For this purpose, we checked that the determinant for the correlations matrix for each scale was close to 0 and that the result of the KMO test was close to 1 (Levy and Varela, 2003). Then EFA was performed using Principal Component analysis with Varimax rotation as the extraction method, finding that the factor loadings in the rotated component matrix were, depending on the sample size, above 0.3. In order to determine the number of dimensions in each scale, we required eigenvalues above 1 and that the percentage of explained variance was close to 60%. Study of the communalities obtained, which in all cases reached values above or very close to 0.50 (Hair et al., 1999), indicated that all the items helped explain the factor solution obtained.

Scale reliability was analysed using 4 tests: (1) Cronbach's Alpha, (2) total item correlation, (3) composite reliability (CR), and (4) average variance extracted (AVE). The value for Cronbach's alpha was above 0.7 (Nunnally, 1978), fluctuating between 0.745 for the training scale and 0.935 for the ambition scale. In all cases, correlations between the items on each scale was in excess of 0.5, and for composite reliability and average variance extracted the results were above or very close to 0.7 (Hair et al., 1999; Luque, 2000) and 0.5 (Hair et al., 1999; Sharma, 1996), respectively. It can therefore be deduced that there is internal consistency and high reliability in all the scales.

The convergent validity of the scales was studied by reviewing the value of the factor loadings of all the items and their degree of significance. All the loadings were significant and exceeded 0.5 (Hildebrandt, 1987), proving convergent validity.

Discriminant validity was analysed using 2 tests to check that: (1) correlations between the variables were not above 0.8 (Hair et al., 1999), and (2) the square of the correlation between each pair of variables was not above the average variance extracted obtained for each of these variables (Fornell and Larcker, 1981). The results show that there is discriminant validity.

We performed 2 tests to study nomological validation: (1) correlations between all the variables in the study and their significance (Sharma and Chan. 2011), and (2) the relations between these variables and the employability variable because, as explained in the literature review, they all turned out to be antecedents of employability. According to the results of the first test, all the variables were mutually and significantly correlated at the 0.01 level. For the second test, first we validated the employability scale, measured by 3 items adapted from Wittekind et al. (2010). We then checked that all the variables are antecedents of employability, and found that the strongest relations were with the variables for self-confidence, competencies and self-efficacy for job searching, and the weakest were with ambition and training. We therefore deduced that there is nomological validity in all the scales.

5. Conclusions

The main purpose of this study was to validate a set of scales for measuring the internal determinants of the employability of university students, and it was motivated by the lack of validated scales at confirmatory level (Dacre et al.. 2014; Yusof et al.. 2012). As internal determinants of employability, it identifies self-confidence, ambition, competencies, training and self-efficacy for job searching. The analyses performed on these scales regarding content validity, dimensionality, reliability, and convergent, discriminant and nomological validity show satisfactory results and allow us to conclude that the variables of self-confidence and ambition are unidimensional and the others are multidimensional. Competencies were measured on the basis of five dimensions relating to the degree of adaptability of students to different situations, their efficiency in performing tasks, their negotiating skills, their emotions and their form of expression. Training was structured in two dimensions – students' performance during their course of study, and their commitment to continuous training. Self-efficacy for job searching was measured using two dimensions – knowledge about the desired job, and predisposition in selection processes.

This study should therefore be of use for three groups. Firstly, it amounts to important progress for future research in that it proposes a set of scales for measuring the internal determinants of employability and validates it at confirmatory level. Secondly, students are offered a tool that may help them to focus their efforts on improving or developing the

attributes that might make them more employable. Finally, it enables universities to identify activities that will help develop the attributes that students need.

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Fostering entrepreneurship in an international university collaboration

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Abstract

The European Union is taking action on enhancing entrepreneurship in Europe and recommends appropriate entrepreneurship training in schools and higher education institutions. Due to the globalization of businesses it seems to be appropriate to realize an international perspective on entrepreneurial issues and to develop international programmes for young entrepreneurs. In this case study, we examined an international university collaboration between two universities, one in Austria and one in the United States. The programme's goals include the establishment of an international network for students and an awareness of the students of different cultural dimensions and entrepreneurial mindsets. Our findings show how this programme enables the students to work on their professional and behavioural skills, how these students work practice-oriented under the guidelines of experts from different entrepreneurial mindsets and how they become aware of cultural differences. Besides other aspects, it seems to be advantageous for international entrepreneurship programmes to remain open and flexible during the whole process and to offer a programme that allows students to integrate participation into their regular studies. Furthermore, it seems beneficial that students can tailor the programme to meet their specific needs.

Keywords: entrepreneurship education, collaboration, mobility, internationalization

1. Introduction

In response to the growing importance of small businesses and start-ups, the European Union seeks to enhance entrepreneurship within Europe in order to develop awareness of this career path from primary school to university (European Commission, 2006). As a consequence of these efforts, entrepreneurship education programmes became a part of many higher education institutions and several regions tried to build fruitful entrepreneurship ecosystems to foster the local start-up scene. But with respect to the intense competition in international markets, small and medium-sized enterprises often face special challenges (Etemad, 2004). Therefore, it seems reasonable that young companies and their founders should know about cultural differences, foreign ecosystems and diverse entrepreneurial perspectives and approaches in order to increase their chances of a successful implementation of their business idea.

In the course of this paper, we examine an international entrepreneurship programme that takes place in the United States and in Austria. In this case study we investigate and discuss the most important factors regarding the objectives, implementation and content of this programme. This article is aimed at teachers and researchers in the field of entrepreneurship education to provide an insight into international programmes and student mobility to inspire similar programmes in the future. It is considered to share important lessons learned and suggest further fields of development for entrepreneurship student exchanges.

In the following section we provide a very short overview of entrepreneurship education, before we describe our case study. Afterwards we discuss our results in the light of the analysed literature and draw some conclusions for the development of international entrepreneurship programmes.

2. Theoretical background

There is a consensus that entrepreneurship can be taught, and there is evidence that entrepreneurial attributes can be positively influenced by entrepreneurship education (Gorman, Hanlon, & King, 1997). This impacts students' awareness of entrepreneurship as an alternative career path to employment and provides them with skills needed to start and successfully run their businesses (Gorman et al., 1997; Slavtchev, Laspita, & Patzelt, 2012). The literature emphasizes different key aspects in entrepreneurship education, for example:

Professional skills. Entrepreneurship education should provide basic skills in traditional business disciplines, e.g. management, marketing, controlling, finance and accounting to enable students to manage a company (Jones & English, 2004). Being aware of the basics of the market environment and insights into economics can complement this knowledge to

assess business ideas and their chances. Many authors propose a mixture of professional competences and soft skills (Plaschka & Welsch, 1990; Vesper & McMullan, 1988).

Behavioural and attitudinal competencies. This category covers all aspects of soft skills, such as personality traits, communication, language, personal habits and social manners, as well as competences that are more entrepreneurship-specific, like opportunity recognition and assessment, negotiation, leadership, risk management, commercializing, creativity and creative thinking, marshalling resources, focusing, self-efficacy and networking (e.g. Jones & English, 2004; Morris, Webb, Fu, & Singhal, 2013; Plaschka & Welsch, 1990; Vesper & McMullan, 1988).

Practice. The literature often states the relevance of learning-by-doing activities in a group setting or network context (e.g. Rasmussen & Sørheim, 2006). Practice-orientated activities, such as working in start-ups or starting businesses as coursework, writing business plans, meeting entrepreneurs, simulations, videos of new venture start-ups, role play and business games play another important role (e.g. Clouse, 1990; Vesper & McMullan, 1988).

Awareness and self-assessment. Entrepreneurship education should enable students to discover their specific abilities and inform them about alternative career options that might be suitable for them (Graevenitz, Harhoff, & Weber, 2010). Through such courses students acquire a more realistic perspective on what it takes to become an entrepreneur, which can result in undecided students either enhancing or abandoning their ambitions to start their own business (Oosterbeek, van Praag, & Ijsselstein, 2010; Slavtchev et al., 2012).

3. Case study

In this section we analyze the international programme and the situation at the investigated universities and elaborate the most important factors regarding objectives, implementation and content. The locations in this case study are in the United States and in Austria. The former one has about 38,000 residents and 21,000 students and is located next to one of the largest entrepreneurial ecosystems in the United States. The latter one has about 290,000 residents and 60,000 students and has a steady growing entrepreneurial community. The situation on both locations is characterized by different study rules, very dissimilar mindsets regarding the affinity towards entrepreneurship as a possible way to create one's own future, and a different cultural attitude towards failure.

3.1. Objectives of the programme

The universities in this programme established an extensive exchange programme first and foremost to open the students' minds to different approaches towards entrepreneurship, to enable insights into different entrepreneurial ecosystems and to connect students from

different backgrounds and life realities with each other to build friendships and business relationships. The programme provides essential basics about entrepreneurship in different environments to increase the general understanding of entrepreneurial cultures and to promote intercultural thinking and acting. Students should acquire a theoretical and – very importantly – a practical understanding of what it takes to found a company in the two countries. The outcome of the programme should result in intensified relations between the two continents. Students learn from each other and furthermore they see and feel the different perspectives of both mindsets and realities. Moreover, they study the two different business locations and their advantages and disadvantages. The collaboration therefore comprises the following goals:

- To initiate an international partnership between universities in Austria and the US.
- To establish an international network of entrepreneurs between the two regions.
- To enhance the visibility and reputation of both (entrepreneurial) regions.
- To sensitize students from both universities to the topic of entrepreneurship.
- To sensitize students to the cultural dimensions of entrepreneurship.
- To familiarize students with two different entrepreneurial ecosystems.
- To create and understand different entrepreneurial mindsets among the students.
- To initiate entrepreneurial student projects.
- To inspire students to engage in entrepreneurial activities.

3.2. Implementation of the programme

In the programme's development phase, it was necessary to decide how profoundly the programme should be integrated into existing study curricula. It was decided to integrate it by granting ECTS credits for all participating Austrian students and academic credits for the students from the United States. These can be accounted for elective courses to the amount of five ECTS or three academic credits, so students can integrate the programme into their regular studies without 'losing' time. Furthermore, students can participate irrespective of their studies and academic progress. They can also acquire an 'International Entrepreneurship Certificate' to formally confirm qualifications for their further career.

Except for the cost of the flights, the programme is free of charge for the students and is funded by the entrepreneurship departments and the business faculties of the involved universities. Due to limited resources, the decision-making and funding processes only proceeded slowly during the development phase. For the US university in particular, it proved to be difficult acquiring such heavily supported funding, while the process in Austria progressed more quickly.

The selection process of the students aimed at filtering not only the most qualified but also the most interested and motivated students to take part in the exchange. Both universities established an independent process to each select 20 students. Besides other criteria, the curriculum vitae, entrepreneurship and work experience, the motivation letter and a (potentially) concrete business idea were rated by five staff members to ensure an objective selection.

3.3. Content of the programme

The programme consists of four stages, which are depicted in Figure 1. Generally, the programme is designed interactively, so that students can perform much of the work on various questions independently, while being mentored by faculty staff and practitioners.

STAGE 1	Week Austria (5 ECTS)					
	Day 1 Idea and Team Formation	Day 2 Business Modeling	Day 3 Marketing and Customer Feedback	Day 4 Field Trips	Day 5 Business Location Day	Day 6 Final Presentations
STAGE 2	Business Model Canvas and Reflection					
STAGE 3	Week United States (3 Credits)					
	Day 1 Introduction to 3D Printing	Day 2 Entrepreneurial Mindset	Day 3 Field Trip Day	Day 4 BMC and Ecosystem New York	Day 5 Final Presentations	Day 6 Socializing
STAGE 4	Final Reflection					

Figure 1. The Annual Transatlantic Entrepreneurship Academy. Source: Authors' illustration.

The *first stage* takes place at the Austrian university and lasts a week. In this week students receive a broad introduction to the differences in the entrepreneurship ecosystems and cultures. Activities will contain team building, idea generation and conception of start-up ideas as well as the preparation of the business model canvas. The week is organized in the form of a start-up camp, where students cooperatively work on their start-up ideas and pitch the outcomes. This is a very practical approach towards entrepreneurship, with a lot of hands-on tasks, creating a minimum viable product, collecting customer feedback and improving as well as iterating the products. Along with the practical sessions, students will hear from experts from real businesses as well as lecturers and professors all the theoretical background they should have. They further have to deal with very specific questions concerning the ecosystems specifics of both the United States and Europe. At the end of week one, students should have a basic knowledge of what it takes to found a company,

should know about the main differences of the two business locations and should be able to pitch their start-up ideas in front of judges.

The *second stage* starts after week one in Austria and ends when the students go to the United States. In this stage the teams should work from home, should use the business model canvas, improve their ideas and work independently via social media, Skype and other tools. In addition, the students need to write a reflection about week one of the programme. Based on these reflections the third stage of the programme will be customized to the needs of these students.

The *third stage* will intensify the work on the start-up ideas, will work on 3D printing in order to create minimum viable products and will have a focus on the pitching skills as well as the entrepreneurial mindset that is needed for young entrepreneurs. At the beginning of the week in the United States, the business model canvas should be ready for evaluation. The content of this stage is deliberately variable and depends on the feedback and insights of stages one and two. Furthermore, both universities will reflect on the goals attained, as well as the good and bad outcomes of the previous stages. Apart from the flexible contents, this stage definitely involves implementation planning and the development of early prototypes, mainly in the form of 3D prints. At the end the ideas are pitched and students receive feedback from qualified judges who are also available for extensive Q&A.

The *fourth stage* provides the opportunity for a final reflection about the experience and the lessons learnt by the students. Similarly to the second stage, students shall give the organizers feedback that will directly be used to improve the programme for the following year. To increase involvement it is furthermore planned that students participating in this year's programme will become project coordinators for the next year in order to guarantee its improvement by having those with first-hand experience working on it.

4. Discussion

According to our short literature review in section 2, entrepreneurship education should target different aspects. The programme meets these aspects in various ways:

Professional skills. The programme provides fundamental knowledge in creating, conceptualizing and developing an entrepreneurial idea. Students further learn to understand and apply the start-up management template, the business model canvas. The aim is to give students useful (management) tools for an upcoming start-up phase.

Behavioural and attitudinal competencies. The programme's international and intercultural approach opens the students' minds to another entrepreneurial ecosystem and offers the challenge to deal with it in a safe environment. They also improve their social

abilities, especially when working in international teams, which involves occupying and distributing roles within the team, managing (cultural) conflicts and creating a sense of togetherness.

Practice. The whole programme provides a high level of practice orientation. Students work in interdisciplinary teams to develop their own business models. Workshops on storytelling and pitching, legal basics, design thinking, marketing, 3D printing, and e-business are included in the programme. The multi-professional mentors form a key part of the programme as they advise on practical issues such as marketing, sales, design or even financing and software development. Through individual and personal coachings, open questions are handled competently and quickly.

Awareness and self-assessment. This programme leads to a better political, economic and cultural awareness of entrepreneurship. Besides that, it is not limited to business students, ensuring that students of all disciplines can apply, participate and become aware of entrepreneurship as a possible career option. The programme enables them to better assess themselves and their business ideas. Students learn about their strengths and weaknesses and find out whether they are qualified as an entrepreneur or not.

5. Conclusion

In conclusion, this case study provides some interesting insights for the implementation of international entrepreneurship collaborations at universities:

First, it requires the partners to avoid imposing their own (cultural) rules and conventions on others. This counts for the content as well as for bureaucratic obstacles that occurred during the development and implementation of the programme as the number of people involved in such a project can get surprisingly high. It also required a considerable amount of workforce, which should be scheduled very carefully by the executing department.

Secondly, it seems to be advantageous to provide an interdisciplinary approach, which ensures that all students – and not only business students – can become aware of entrepreneurship as a career option. Students also seemed to benefit immensely from their manifold proficiencies. Moreover, it appeared to be beneficial that students could tailor the programme to meet their specific needs. Like the schedule for Stage 1, which was too tight for one week but was successfully adjusted for Stage 3.

Thirdly, the flexible integration into regular academic studies has to be emphasized as today's students are often facing time or financial pressure. The integration into curricula through elective courses allowed the students to attend the programme without 'losing' time and the university sponsorship enabled participation without further financial risks.

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Personal development in the virtuality; online activities for individual and group growth

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Abstract

Online teaching is commonly offered for courses and it is aimed students acquire specific skills based on the subject requirements. Regarding soft-skills, collaborative and creative activities are usually deployed face-to-face in contrast to online environments, where communication, group dynamics and activities that require interactivity among the participants can be managed easier. Because of this we loose skills acquisition opportunities and other potential benefits of real collaboration mediated by on-line environments.

We propose an ICT-based method appropriated for project-based learning, innovative teams and personal development. It has 7 phases and has been designed under the theories of field theories of humanism with the main aim to make possible that everybody in the on-line platform can grow and develop individually together with the group. Professor can apply this as a whole (the 7 phases) or some of them as we have related the phases with on-line tasks. We tested this method with a group of 17 post-graduate students. We concluded that when members have enough maturity and experience, these ICT-based-methods make shared learning possible, with great impact on the course skills and competences, but also on soft skills, which are acquired informally while learning the main course subject.

Keywords: *shared learning; project-based learning; Ed-Way; Edueca; eLearning; collaboration.*

1. Background

eLearning (Clark and Mayer, 2016) has favored the development of technological tools and new educational paradigms with an ongoing development (Eurostat, 2017). Virtual teaching is not only content delivery, that is the traditional Virtual Learning Environment (VLE) (Weller, 2007), or management; Learning Management System (LMS) (Watson, 2007) , but also creating comfortable learning places; Personal Learning Environments (PLE) (Veletsianos, 2010), connections with people; Personal Learning Network (PLN) (Couros, 2010), still with challenges (Cabero-Almenara, 2016) pending to solve.

In this paper we prefer to focus on the benefits on networking (PLN) and the growth of individuals by building their own place (PLE). We tested these methods for shared learning, where we are part of a group and at the same time we aim the growth as individuals.

We have focused the design of the method we propose on two different cases. The first one is centred on the Universitat Jaume I, Department of Mechanics and Engineering, by Teresa Gallego and Belinda López-Mesa (2007) where they employ a project-based learning (PBL) approach; students work on real project which are used for practical activities. Students are being trained on the specific competences while having to know each other and complicating the definition of group members (Gallego & López-Mesa, 2007, p.5). PBL methodology provides benefits while challenges.

The second study-case considered for our methodology proposal is based on the Universitat Oberta de Catalunya, School of Business and Economics (Serradell-López 2014, Fitó-Bertran, et Al. 2014), where a student group manages different virtual business and different skills are exploited: communication, group participation, getting global perspective, requiring the specialization of the individuals while, at the same time, acquiring group strategy.

Based on the previous study cases needs, we proposed and tested a 7-phase group development process which takes into consideration the individual facets and aims with global and group strategy. The implementation of an educational methodology centered on personal development and personal reflection needs to respect working criteria based on the own perceptions of the groups and each one of its components. Therefore, we need to respect the following premises under the context of humanist field theories:

1. Every group of people tends to find their own inner balance. People who takes part in a group, tend to self-organize and do it from a chaotic perspective (Friedman, 2002).
2. Every human group goes through different phases while its members interact. All of them must be attended in order to respect the perceptions, feelings and learning

needs of each group (Lewin, 1947); orientation phase, phase of conflict, grouping phase, team phase.

3. Every group requires a systemic approach that allows a multifunctional and multidimensional analysis of the existing processes in learning group (Satir, 1988).
4. Every group requires interaction in its right measure. The protagonism of the group is within the group itself and everything that happens in that context (Polster, 1974).
5. Every group has to be stimulated to find their own reality. All facilitation behavior within the group must be focused to their own self-organization and the elaboration of their own reflections and responses (Goodman, 1966).
6. Every group needs a functional and bio-positive approach. To do this, we must emphasize the internal processes of reflection within a group (Goodman, et Al. 1951).
7. Every group needs a work structure that supports its own internal reflection and always makes it oriented to the search for continuous achievements (Reich, 1980).
8. Every group needs respect based on personal knowledge and mutual trust (Goldstein, & Sacks, 2000).
9. Every group needs to build goals based on their own resources and perceptions. This means boosting a climate open to personal respect and intimate contact with the facilitator (Horney, 1950).

2. Method

Based on the premises stated before about individual-group balance and strategy for individual and group development, we applied the Ed-Way (www.ed-way.eu) findings and results; Ed-Way is a KA2 Erasmus+ Strategic partnership project coordinated by “Centre for the Innovation and Development of Education and Technology” (“CIDET”). This project produced a manual (in press) that facilitates, by means of the usage of new technologies, the use of ICT-based tools and activities, the acquisition of personal, social and formal skills, competences and qualifications. However, these competences are not subject-based (as it could be in courses about history, economy, sciences, law, etc.) but they are based on common skills that are required when dealing with intrinsic motivation, individual leadership, collaboration, creativity and group aims.

In Table 1 we described the 7 phases of the method proposed. In each phase there is a task that we describe shortly afterwards, relating it with ICT-based activities. Each of the phases input is based on the previous phase output.

Table 1. Phases for personal and group growth

Phase	Relational theory	Task	Aim
1	Personal motivation	Timeline	Emotional intelligence
2	Personal Leadership	Empathy Map	Positive thinking
3	Workgroup	Wheel of needs	Temp phases
4	Objectives targeting	Need list	Building learning challenges
5	Use of language	Impact map	Expressing positively
6	Perception phases	Personal evaluation	Constructive dialogue

Macintyre 2012; Ferreira et Al. (2015); Max-Neef (1992); Noble, & McGrath, (2008)

3. Piloting

We applied the method described in the previous section in the online learning platform Edueca (www.edueca.com). We proposed a project-based learning activity to 17 learners and monitored them while they were going through the 7 previous steps during 3 months.

Table 2. ICT based activities

Phase	ICT-Tool (Edueca)
1	Work individually to fill a board about present individual situation, background and interests. Board allows open replies, and results are shared afterwards to all the group. We only want the exposition of the members, creating an assertive working environment, everybody understand other people aims. Voting system allowed to put in common the most preferred aims.
2	Work in pairs (synchronous). The main objective is to know other people talent, potentialities. In this phase, links that are beginning to be created, will later be useful for the constitution of a collaborative group. This is repeated 3 times mixing team members. New roles are listed and classified. Edueca stores these preferences (links between aims, potentialities and interests).
3	3-people team (asynchronous) builds a common vision. We envisage what we can reach based on our own potentialities and aims. This is repeated 2-3 times mixing team members. Results in previous phases are now evaluated by each member of the team and finally by the whole group.
4	4-people team (asynchronous) with the common aim decided in the previous phase, they can place the challenges they find towards success using a virtual board. The potentialities (in 2nd phase) are annexed in this board as resources, and linked to

individual aims (as stated in 1st phase), creating a graphic with nodes.

- 5 Individually (in a board) take decisions (steps) that would guide the group to the achievement of the general aims. The “sentences” used by the members should be always positive. Edueca makes possible to repeat these steps to link decision among members building networks of interests (that are both-direction flows) or networks of needs (one direction flows). These decisions are later transformed in actions plans, that follow a path from present situation to the final aim.
 - 6 As main learning activity happens, blocking situations appear, alternative aims could be considered. This is an individual activity where learners publish the issues and challenges that appear to the public. The group is the one that decides what to do by trying to find a solution (interactive process) Edueca uses walls, graphs and selection of skills modification of aims forms for the unblock of the scenario.
 - 7 Conclusion reach by the visualization of aims achieved, but an open discussion (asynchronous in a forum) about how to proceed afterwards.
-

4. Results

The piloting was applied to a 9 learners between 20 and 41 years old enrolled in an online course “Natural resources management” which included the development of a project (report describing the strategy and actions) related to protect and preserve a natural resource. After the training phase where they had to access materials, videos and submit some tasks (reports and questionnaire), they started the developmental phase guided by an online facilitator as stated in Table 2 phases. Learners’ experience was observed and conclusions were gathered and summarised in Table 3.

Table 3. Examination conclusions (participant observation)

Phase	Results
1	This resulted in an increased awareness of the group of the different background and needs of the participants. It was revealed in the online board not only the interests of the participants but also their personal situation (work, family, life) and hope. More common needs (objectively) were classified and selected among the group. Participants acknowledged that visualising other learner’s needs and interests help them to know new applications of topics covered in the course.
2	Learners were capable to explain the strengths and weakness to others, but the fact of doing this in pairs, helped to weight them, discover new talents and reduce the weaknesses importance. It has been difficult to identify which are the good talents or if they could be useful. In this phase it was only aimed to show as much as possible. A virtual list of talents was published, and later organised by categories and areas and new roles arise from this

organisation. It was not possible to link them with the previous phase needs as it was planned, so the facilitator considered to wait for next phase.

- 3 The 3-people team had access to a board where they could select all the aims (from phase 1) and the talents (phase 2), this allows to create linking and strategies. We moved from personal and individual aims to group strategies. This activity resulted as a brainstorming, concluding with a lot of different strategies. A huge effort was put here to try to clarify these aims. Some groups resulted on very wide, general, and abstract objectives, while others proposed direct activities (too operational).
 - 4 With the group strategy selected, in a discussion (using a forum) 4-people team extracted the challenges, risks and issues that make difficult the implementation of the action plan. So far, the main purpose was to detect those difficulties and arrange the actions (timing) linking with the talents (identified in phase 2).
 - 5 Each learner, having the general vision of the project, and with the challenges identified proposes solutions, alternate actions or changes using a positive language. Learners could also suggest changes to previous action plan base in their own interests, motivation and expertise. The project is now being produced (in a form of shared document) which includes a logical structure (path to achieve the general group strategy) based on individual talents, skills and motivations. Edueca worked as a social network.
 - 6 Putting the action plan in practise (at least, only initially) makes possible to see that some of the actions proposed were too complex with low impact. Difficulties on the group management arises, some of them were solved by the mediation of the facilitator. The fact of having clear the individual aims (and most important, the talents) from the beginning and the group strategy helped to drive the building of the project.
 - 7 Project ends with the creation of a common and agreed product, but we did not want to focus on this, but on how the process went, competences learnt, attitudes and values acquired. This summary was done as in a way of questionnaire: How I felt, What I have learnt, Why it was useful for me, that later was made public to all the group and allowed each other to give feedback (as in a way of open forum).
-

Learners valued the fact of being capable to create a new project as a group that mixed so many talents, opinions and needs, although they agreed that required extra time and effort not only to work collaboratively, but also during the initial phases, where they had to decide what should have been done, and how. We concluded:

Learners could put into practise the topics they learnt in the first stages of the course (that was more theoretical), while at the same time, they had to contextualize and give a purpose, moving to theory to an specific aim. That potentiate the skills and competences that were part of the course.

The fact of having to provide opinion, defend some aspects of the project and try to understand other learners position help them not only understand better some of the topics of the course, but also to communicate, analyse and propose, discovering new perspectives of the course contents and personal points of view or aspects (problems, potentialities) they were not aware.

Learners acquired soft skills and transversal competences, as communication, leadership, responsibility, planning, teamwork, etc. This learning was produced informally as it was not planned; it was observed after the evaluation of the course, in fact, some learners had difficulties on this, which we consider positive as those are necessary job-skills not usually targeted.

The way of working (from phase 1 to 7, from individual to group) increased their awareness of the necessity of work in an interdisciplinary team, and still being possible to fulfill everybody motivation, including the acceptance of having to give in. Depending on the needs of the professor it is still possible to implement part of the method proposed partly as we designed it modular.

The professor acts a facilitator, not teaching, promoting the individual development while guiding the group to a common aim. This requires specific skills and techniques which are not covered in this paper, but are part of the Ed-Way project which includes a training programme for professors.

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Teaching competences in Italian universities: an attempt of classification to inform professional development processes

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Abstract

How we can improve the quality of teaching in the university degree courses? What are the professors' practices and the beliefs about their role in the students' learning process? A group of spokespersons of seven Italian Universities has carried out an integrate sources study to answer those questions and to define a programme of activities for developing didactic skills of the teachers. This paper aims to illustrate the design and the results of a research project which involved 4,289 university professors (59% of the target population), who were teaching courses at bachelor and master level during the academic year 2014/15. The data were directly gathered by a CAWI questionnaire which was distributed to the whole teaching staff; the survey results were linked to administrative data related to the educational offer and students' evaluation of teaching in the same academic year. The results were summarized using some indicators, which showed the diffusion of good practices of teaching, support needs, beliefs, interest and availability of the respondents. We verified the reliability of these indicators and, by means of them, we identified sub-groups of areas of expertise and needs to involve teachers in appropriate different and integrated activities, directed to develop teachers' professional competences.

Keywords: *Academic teaching; teaching innovation; educational practices; sources integration; questionnaire validation; teachers professional development.*

1. Introduction

Improvement and innovation in teaching are constant elements in universities all over the world. Major changes nowadays concern the use of technology, the internationalisation, the overall teaching process and system (EUA, 2015). A crucial aspect is teaching effectiveness and its impact on the quality of learning (Biggs, 2011). Teachers are called to use active learning strategies, to involve students in the classroom, to promote meaningful learning. In order to do that, competences in designing learning outcomes, choosing and implementing teaching and learning methods as well as strategies for assessment and evaluation are required. Therefore, academic institutions are responsible for promoting staff development programs to enhance teaching competences (OECD, 2012; High Level Group on the Modernisation, 2013; ENQA, 2015).

The Italian scenario, unfortunately, appears late in this field (Felisatti, 2016). The University of Padova in 2013 promoted a first experience with the project “PRODID-Preparazione alla professionalità docente e innovazione didattica” aimed at developing an integrated system (Diamond, 2002) to improve teaching competences and academic innovation. PRODID project promoted a research-based approach to creating training programs, faculty learning communities, pilot experimental contexts where teaching innovation could be tested and monitored (Felisatti & Serbati, 2014). Following an evidence-based approach, the project aimed at highlighting the teachers’ needs, beliefs and practices of teaching and learning, which may constitute a privileged context for the development of innovative teaching activities within the institution. A questionnaire has been drafted, inspired by the *Framework of teaching* (Tigelaar et al., 2004); the dimensions investigated have been the following: The Person as Teacher, Expert on Content Knowledge, Facilitator of Learning Processes (developer, counsellor, evaluator), Organiser, Scholar/Lifelong Learner. The questionnaire sections were organised as follows: the first section focused on “practices” developed in teaching activities in the previous academic year; teachers were asked to reply to the questions referring to those real activities carried out previously. The second section deepened teachers’ “beliefs” about teaching in higher education, and the third section focused on teachers’ “needs”. Considering that PRODID aimed at designing and testing training programs for teachers’ professional development, it seemed crucial to understand the real needs of teachers in order to provide the best support possible for them and for the improvement of pedagogical competences. Therefore, questionnaire results were used to define teachers’ profiles, based on previous experience, beliefs, interests, needs, availability, to develop tailored activities.

After this first project at University of Padova, the questionnaire has been slightly changed and it is now used for a national research called “Didactics and Teaching in University”, carried out by 7 Italian Universities (Bari, Camerino, Catania, Firenze, Foggia, Genova,

Torino), with the aim of validating the instrument and guiding institutional decisions on continuing professional development actions.

The aim of this contribution is to introduce the main features of this innovative survey and show how the collected data may be used to provide a first classification of teachers' areas of expertise and needs.

2. Method

The survey "Didactics and Teaching in University" aims at testing the capability of a questionnaire to describe a picture of the teaching experience in use among Italian Universities, and classifying their practices, beliefs and needs, with regard to their teaching activities developed in the university classrooms. This computer-assisted web interviewing survey is integrated with administrative data, related to the teachers and the educational offer of the different academic institutions. The experimentation involved 7 Italian Universities, located in different geographical areas and having various dimensions, according to the number of students and teachers. Two units of analysis may be specified: the university professor and the didactic activity (DA) (at least 20 hours).

The reference population is composed by all professors of all Universities. Therefore, the study involved 7,278 professors and 11,948 DAs were surveyed in the questionnaire section that measures the didactic practices used in the teaching activities. The involved universities provided the administrative information, which allowed to adequately qualify the characteristics of each teacher (i.e. gender, age, position, etc.), DA and research-didactic context (i.e. name of the courses taught by each teacher in the previous academic year, degree level, number of hours, etc.). The online survey took place between June and August 2016. Teachers and DAs data were linked to each questionnaire, by specific procedures of management of the personal identification code provided for the used software (*LimeSurvey*). This allowed to manage the invitations, organize the requests, associate to every teacher their attributes of interest, guaranteeing the anonymity of the information. These attributes concerned the appropriate DA for every respondent, the degree course of the considered DA, the year of course, the numbers of hours of the DA (each teacher could respond to the questions, referring to their own didactic activity taught in the previous academic year, which automatically appeared in the questionnaire).

The questionnaire consists of three sections. The first section is composed by 10 dichotomic items. They are proposed to the respondents for each of the DAs developed by them (max 2) and investigate the reported usual didactic practices of each of the considered DAs (0=No; 1=Yes). The second part aims at understanding what are the beliefs and the needs that each teacher feels crucial is in his/her DA. Differently from the first section, this part focuses on the professor and it is composed by 23 auto-anchoring items: the answers of

each proposed statement have the same scale from 1 (not agree at all) to 7 (fully agree). In the third section the availability of the teacher to a follow-up contact is assessed. Furthermore, this last section proposes some open questions around possible innovations, critical points, useful supports for a future improvement. For further explanations about the questionnaire administration and the item contents see Dalla Zuanna *et al.*, 2014. A preliminary phase of pre-test allowed to check the content, the form, and the technical aspects of the survey tool. Particular attention has been given to the communication process and the monitoring of the attendance to the survey, for instance through specific interventions and focused requests.

3. Results

The total number of completed questionnaires is 4,289, leading to a response rate (with respect to the teacher population) of 59%. Disaggregating it by teachers' features (gender, age, position and so on), we can observe that women were more likely to answer than men, as well as a clear negative gradient by age (the younger the higher): the response rate moves to 68%, for respondents aged from 30 to 45 years, to 31% for teachers older than 70 years. Respondents were asked to complete the first part of the questionnaire for at least one of their DAs: 2,760 teachers provided answers for two DAs, while 1,529 to just one DA (the average value is therefore 1.6 activities per respondent). Overall, 7,049 DAs were investigated.

Table1. Dimensions of the first part of the questionnaire (“Teaching practices”)

MACRO-DIMENSIONS	DIMENSIONS OF THE QUESTIONNAIRE	% OF USE AND # OF ITEMS IN EACH DIMENSION
Facilitator of learning processes	Teaching and learning methods	63.5 (2)
	Use of technologies in teaching practices	46 (3)
	Assessment and evaluation methods	59.5 (2)
Organiser	Integration of teaching practice in the curriculum	68 (2)
	Scholar/lifelong learner	Use of student evaluation of teaching

Table 1 summarises the dimensions underlying the practices analysed in this part of the questionnaire (for length constraints, reporting descriptive statistics for the answers to each question was unfeasible). One of the two items investigating the “*Integration of teaching practice in the curriculum*” show the largest proportion of positive answers (90%), signalling that respondents strongly believe their teaching activities play an important role in the general educational path they are involved to. On the other hand, looking at the answers to all questions of the “*Use of technologies in teaching practices*” dimension, it is

very high the proportion of teachers who do not produce technological (multimedia) materials (more than 50% of teachers) or exploit advanced web opportunities (even 74% of them). The low proportion of positive answers (lower than 50%) to similar questions included in the "*Integration of teaching practice in the curriculum*" and in the "*Teaching and learning methods*" dimensions reveals an overall weak use of both the contribution of external experts as a part of the lessons and the fulfilment of teaching activities in coordination with other teachers teaching similar topics.

According to the macro-dimensions introduced (Tigelaar *et al.*, 2004), Table 2 lists the seven dimensions investigated in the second part of the questionnaire (Teaching beliefs and needs), as well as the number of items within each dimension. Each item basically shows an asymmetric frequency distribution (median value has a range between 5 and 7), apart from the "Assessment and evaluation methods" dimension, which items roughly present symmetric distributions (the average value is indeed around 4).

On the one hand, the passion for research and the passion for teaching report the highest evaluations (particularly the first one, where the median is equal to 7 in two out of three items), with a positive relationship (in other words, few respondents – roughly 10% – are inclined to define themselves as "just" teachers or "just" researchers). On the other hand, the largest variability may be observed among the items identifying the "Reflection and strategies for improvement" dimension. The largest proportion of missing values are collected by the item that asks about the use of the target language (English) within the "knowledge transmission" dimension.

Table2. Dimensions of the second part of the questionnaire ("Teacher beliefs and needs")

MACRO-DIMENSIONS	DIMENSIONS OF THE QUESTIONNAIRE	MEAN AND # OF ITEMS IN EACH DIMENSION
The person as teacher	Passion for research	5.7 (3)
Facilitator of learning processes	Teaching and learning methods	5.2 (4)
	Assessment and evaluation methods	4.1 (3)
Expert on content knowledge	Focus on students' needs	4.6 (3)
	Knowledge transmission	6.1 (2)
Scholar/lifelong learner	Reflection and strategies for improvement	4.2 (4)
The person as teacher	Passion for teaching	6.2 (3)

All answers are then classified in six categories, according to some criteria defined through the combination of six different indicators, five of them obtained from the collected answers. The indicators are:

1) *Interest*. It is calculated exploiting the answers to the items of the "Reflection and strategies for improvement" dimension from the second part of the questionnaire ("Teaching beliefs and needs"). A factor analysis on these items is performed and the factor

score for each respondent is then computed. The *interest* indicator is expressed by a 5-point scale: low (21%), middle-low (11%), middle (34%), middle-high (14%), high (20%).

2) *Need to support*. It is calculated exploiting the answers to the items of the “Focus on students’ needs” dimension from the second part of the questionnaire (“Teaching beliefs and needs”). Similarly to the *interest* indicator, a factor analysis on the items is performed and the factor score for each respondent is computed. The *need to support* indicator is expressed by a 5-point scale: low (16.5%), middle-low (10%), middle (42.5%), middle-high (17%), high (14%).

3) *Contact willingness*. It is calculated exploiting the answer to the last question of the questionnaire; it is expressed on a binary variable, willing (62%) vs unwilling teacher (38%).

4) *Technological practices*. It is calculated exploiting the answers to the items from 7 to 9 from the first part of the questionnaire (“Teaching practices”). It is expressed as the sum of the positive answers to these items (the average value is equal to 1.46).

5) *Methodological/learning assessment practices*. It is calculated exploiting the answers to the items from 1 to 6 from the first part of the questionnaire (“Teaching practices”). It is expressed as the sum of the positive answers to these items (the average value is 1.55).

6) *Student’s evaluation of teaching (SET)*. It is calculated exploiting administrative data, provided by each University and based on the answers to the survey measuring the students’ opinion on the DAs. More specifically, the focus is on two particular questions (“Does the teacher stimulate interest towards the topic?” and “Does the teacher clearly explain?”), which are identified as the most important observed items of a latent variable related to the efficacy of (teacher) didactics measuring the student satisfaction (Bassi *et al.* 2017). It is computed comparing the median value of the answers to each item of each DA. The *SET* indicator is then expressed by a 3-point scale: low (9%), middle (38%), high (53%) satisfaction.

These indicators are combined in order to define six categories grouping different levels of expertise, needs and interest/willing to improve:

1) *Strong expertise and interest*: high or middle-high interest, high technological and methodological/learning assessment practices, high level of students’ satisfaction and teacher’ willingness to be contacted.

2) *Strong expertise and medium interest* (not classified as 1): high technological and methodological/learning assessment practices, high or medium level of students’ satisfaction, further classified as willing and unwilling to be contacted.

3) *Young expertise* (not classified as 1 and 2): *newly recruited* teachers on the tenure track and younger than 45 years, further classified as willing and unwilling to be contacted.

4) *Soft expertise and strong interest/need of support* (not classified as 1, 2 and 3): high, middle-high or middle interest and high, middle-high or middle need to support, further classified as willing and unwilling to be contacted.

5) *Other willingness* (not classified in any of the previous groups): general willingness in being contacted.

6) *Other* (the remaining answers).

Table 3 shows the classification of the whole sample according to the aforementioned criteria. The largest group is composed by *group 4* (about 37%), followed by the *group 2* (23%). *Group 1* comprises about 6% of the teachers' answers as a whole.

Table 3. Classification of different levels of expertise, needs and interest/willingness to improve

Group		Proportion (%)
1.Strong expertise and interest		5.7
2.Strong expertise and medium interest	Willing	14.8
	Unwilling	8.1
3.Young expertise	Willing	2.5
	Unwilling	1.9
4.Soft expertise and strong interest	Willing	25.7
	Unwilling	11.5
5.Other willingness		13.2
6.Other		16.6

4. Discussion

The study allowed to test the questionnaire aimed at understanding teachers' practices, beliefs and needs and classifying them to better tailor staff development programs. The instrument will be available for other Italian institutions interested in collecting a first picture of teaching expertises and desires of support in order to inform decisions regarding training processes. The key areas identified – based on experience, support needs, beliefs, interest and availability - help to propose training actions balanced between individual availabilities and institutional objective to qualify teachers. In the PRODID experience, the results of the questionnaire were supported by a second research step based on a qualitative investigation. Interviews and focus groups deepened and better informed the choice of staff development actions as well as contents and topics to be addressed and discussed.

PRODID project proposed three staff development actions, that may be of inspiration for other Italian universities. *Teachers study group with senior professors* was devoted to improving mentoring, coaching, peer-observation, peer-assessment in order to train teachers who declared to be already competent and interested in teaching and learning to become pedagogical expert who can support colleagues in their department. *Junior staff development program* was offered to newly recruited teacher to develop basic competences in designing, implementing and evaluating teaching and learning. *Workshops and events on specific topics* provided opportunities to learn with colleagues methods and techniques such

as problem-based learning, active learning strategies, flipped classroom, educational technologies, etc. (for a detailed description of staff development activities, please see the project publication: Felisatti & Serbati, 2017).

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Developing problem solving competences through the resolution of contextualized problems with an Advanced Computing Environment

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Abstract

The paper shows how problem solving competences can be developed by solving contextualized problems using an Advanced Computing Environment (ACE). An ACE is a computer system which enables its user to perform numeric and symbolic computations, graphical representations in two and three dimensions, insert embedded components and create interactive worksheet, all in the same user-friendly environment. An ACE allows students to approach a problematic situation in the way that most suits their thinking, to use different types of representations according to the chosen strategy and to display the whole reasoning together with verbal explanation in the same page: in other words, they can fulfill all the processes that problem solving involves.

This paper analyzes a problem solving activity with an ACE proposed by the Department of Mathematics of the University of Turin, and clarifies, also through examples, how the use of the ACE makes it possible to solve real and relevant problems, facilitates the comprehension of the situation and of the Mathematics laying behind and enhance critical thinking.

Keywords: *Advanced Computing Environment; Contextualized problems; Critical thinking; Mathematical competence; Mathematical representations; Problem Solving.*

1. Introduction

The development of problem solving skills has become a major concern of Mathematics education since it has been chosen as a measure of evaluation of instructional systems (PISA, 2003). European guidelines ask schools to prepare tomorrow's citizens to adapt to ever-changing works and to a world that is more and more dependent on technologies (European Commission, 2015). National educational systems have had to come to terms with this and have issued new indications and actions for teacher training, involving new methodologies rooted in problem posing and solving and in the use of learning technologies (MIUR, 2010) (Brancaccio, et al., 2015). The request of making students able to deal with real problems has recently landed into universities, which traditionally pay less attention to didactic approaches.

The Department of Mathematics of the University of Turin has developed an innovative methodology for the development of problem solving competences, to be proposed to secondary school and university teachers and students, deeply grounded on the use of an Advanced Computing Environment (ACE). ACE is a system which allows to enhance the capabilities of scientific objects representation through numeric computations, symbolic calculus, geometric visualizations in two and three dimensions, and embedding of interactive components while maintaining the ease and immediacy of use of a common word processor. Problem posing and problem solving using an ACE thus require to focus on the chosen problematic situation, which must be real or multidisciplinary, and on the modality in which the ACE is used to find solutions. Purpose of this paper it to show how solving contextualized problems with an ACE can help develop problem solving skills. The discussion is held around examples from a project where these methodologies have been adopted.

2. State of the art

While the value of problem solving has been known since Polya's work (Polya, 1957), how the use of technologies affects problem solving activity is a more recent issue. This new theoretical framework is based on the assumption that Mathematical problem solving involves two deeply intertwined processes: the mathematical modellization of the situation and the expression of the reasoning (Carreira, et al., 2016). Modellization cannot take place entirely into the students' mind: real-world and complex situations must be conveyed through a variety of interacting media, which may include words, numbers, symbols, graphics, simulations and many others (Lesh & Leher, 2009). Representation is thus at the core of relevant problem solving, and the multimodal possibilities of representation offered by different computerized systems enable and enhance different approaches to the problem.

Mathematics skills not only are needed to find coherent solutions, but are also reinforced after their implementation (Shoenfeld, 1992).

The Department of Mathematics enters this scenery with the proposal of a new methodology based on problem solving activities through an ACE for enhancing learning. It is based on two assumptions: first, problems should be interesting, relevant, open and real situations, even linked to other disciplines; second, an ACE provides all the modalities of representation for one mathematical object, so that students' reasoning can benefit from having a unique environment for solving problems.

3. “Digital Mate Training” to develop problem solving skills

The activity of problem solving through an ACE has been adopted by the Department of Mathematics in a set of initiatives aimed at enhancing teaching and learning Mathematics. One significant experience has been developed within the project Digital Mate Training (DMT), funded by the Fondazione CRT and carried out through academic years 2014/2015, 2015/2016 and 2016/2017 in collaboration with the ICT Services of the Computer Science Department of University of Turin (Barana, et al., 2016).

3.1. Description of the project

The aim of the DMT is to develop and strengthen Mathematics and Computer Science skills through problem solving activities using the ACE Maple and the Virtual Learning Environment (VLE) Moodle. The three editions involved 150 classes of about 40 high-schools of Piedmont and Aosta Valley each year, for an amount of 3750 students, 120 teachers and 12 university tutors. After an initial training to solving problems using an ACE that takes place in the laboratories of all the schools, 3 students per class – the most skilled or motivated ones - are enrolled to the VLE and participate to an online training. They are asked to solve a problem every 10 days and to submit their solution, which will be reviewed by the tutors. In the meanwhile, students can participate to weekly synchronous tutoring on the use of Maple and they can collaborate with their colleagues through forum discussions. Students are selected in an intermediate competition and a final one.

3.2. Training for the development of competences

During the online training students learn how to solve problems using the ACE. The problems are graduated in difficulty, so that in the first ones students can focus on the use of the ACE, which is often unknown to them, then complexity progressively increases to make them develop problem solving strategies. The problems content is related to the topics studied at school, so that the participation to the training can really help them get higher understanding of Mathematics. All the problems are based on real-life challenging situations. The texts of the problems are split into smaller questions, all of them are open and increase in complexity. The choice of this structure is due to different reasons: growing difficulty helps students going through the problem without discouraging and it facilitates the assessment, moreover it is similar to the structure of the national final examination of scientific high school, so it helps students practice for it. The final point of all the problems asks to universalize the solution to a more general situation. That can be fulfilled through Maple's embedded components, which can be programmed to perform computations over the data given in input and to return representations and results. This request forces students to go through an abstraction process and to better understand all the solving steps. Moreover, they need to learn the simple programming language standing behind the ACE, which will turn out to be useful in their studying and working future.

A specific rubric has been developed to assess the students' competence in problem solving using an ACE. It includes five indicators: understanding of the problematic solution, development of a solving strategy, accomplishment of the solving process, argumentation and appropriate use of the ACE. All the works submitted during the training are assessed according to the rubric and feedback is provided so that students can acknowledge what to improve. The same assessment criteria are applied in competitions, which consist of the individual resolution of a given problem in two hours time.

3.3. How an ACE can help develop problem solving competences: a clarifying example

Various types of representation enable the resolution of a problematic situation. Starting from mental thinking, the solving process can be carried out through several modalities, such as in words, graphically, algebraically, experimentally through computerized simulations. Being able to properly combine those modalities is a crucial aspect in problem solving. Students are free to choose the solving modalities they prefer. This freedom forces them to constantly validate and carefully justify the reasoning: the efficacy of their solving strategy is as important as the clearness of the expression of their solving process. An ACE allows its users to make use of all the representation modalities in a single environment, thus obtaining high levels of clearness and comprehension.

One of the first evident ACE features is that it helps deal with computations that would be hard to be done “by hand”. This has a double effect: students can concentrate on solving the problem rather than on calculating, and the variety of problems that can be proposed to be solved via an ACE is wider. To support these statements, we’ll show the problem proposed to the students of the fourth year of Secondary School in the final competition of DMT 2015/2016, entitled “Gears”:

Inside an old mechanical toy there is a mechanism which makes a siren sound when it turns on: it consists of two gears rotating one against the other. On each gear, in a point of the external cogwheel, there is an electrode. At the beginning, the two electrodes are in contact; when the gears start rotating, every time the two electrodes make contact the siren emits a sound which simulates a real siren. The toy works when the two gears have the same radius.

The first question of the problem was the following:

Provide a graphical representation of the situation in this case. For reasons of simplicity, you can suppose that the gears are circular shaped and neglect the teeth, that they have unitary radius and that the electrodes complete one rotation in one time unit.

The use of an ACE allows each student to develop their own solution strategies according to their own reasoning. In fact, all the students answered correctly to this first question, while their answers widely varied in the chosen commands – which reflect the mathematical tools used - in the deepening of the solution given and in the ability to express the reasoning in natural language. The variety of methods that an ACE admits for representing mathematical objects allows students to concentrate on the resolution if they master the commands and features at their disposal. In order to display mathematical objects through an ACE it is necessary to provide their formal characteristics: it means that graphical resolutions are usually enough to demonstrate the comprehension of underlying mathematical models. In the example, comprehension involves mathematical prerequisites such as the concepts of circle, point, translation, rotation and so on. In the ACE, a circle can be represented by expressing its equation or by submitting the coordinates of center and radius. Students chose their preferred (or both) method for representing the wheel and the electrodes, correctly adapting their formulas according to the syntax of the requested command, as shown in Figure 1. However, the lacking knowledge on how to use the ACE does not penalize students, since they could just write down the equations and submit a free-drawn sketch of the situation.

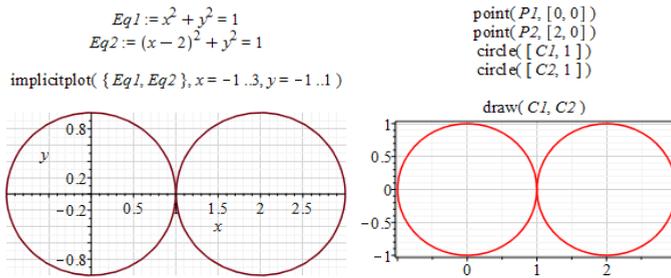


Figure 1. Two different commands entered by students for displaying the wheels.

Well-designed problems often admit a virtually infinite number of different choices for a solution representation, which favors originality in problem solving. In the example, choices widely varied from the essential representation of a couple of trajectories (two circles), to two circles and two points, to the animation of the circles and points. Major advances in the representation of the correct solution coincide with high mastery of mathematical knowledge. For instance, in order to animate the wheels approximated graphics, it is required that the students have understood and decided the variable for expressing the animation, the formulas involved and a proper animation range, as shown in Figure 2.

$$\begin{aligned}
 & \text{animate}(\text{pointplot}, [[\cos(2\pi \cdot t), \sin(2\pi \cdot t)]], t = 0 .. 1) \\
 & \text{animate}(\text{pointplot}, [[\cos(\theta), \sin(\theta)]], \theta = 0 .. 2\pi)
 \end{aligned}$$

Figure 2. Two different commands for creating an animated graphic of the electrodes rotating around the wheel elaborated by students. The choice of parametrization for the rotation reveals the different reasoning.

Learning the ACE's programming language helps put into practice the solving modalities. Computational thinking facilitates the students' approach to the problem: they can split the solution into single steps, focus on steps connection, simplify the reasoning by building original procedures and objects. Interactive components can be used to develop two solving modalities within an ACE: generalization and demonstration of particular cases (deductive reasoning), and exploration and recognition of particular cases (inductive reasoning). In some particular cases, inductive reasoning can be useful to understand, but it is not rigorous in Maths and it can lead students to make mistakes. Let's consider the second question:

If the two gears have different radius, how must the radii ratio be in order for the toy to work? Explore this situation through interactive components, then find a relation that the radii ratio must satisfy in order for the mechanism to work.

Students managed to represent the generalization of the problematic situation via a proper and effective development of interactive components. However, many students managed to provide only a particular case of the more general solution, the one they could notice

through a simulation. The ability of using an ACE cannot overcome mathematical competences: experimental results must be weighted with rigorous calculus. Nevertheless, the use of an ACE can lead student towards correct solutions. In the example, students were close to solving the problem: even if the solutions were not completely correct, they acquired the ability to proceed autonomously through the steps of a resolution of a problem.

4. Results and discussion

The results after the DMT proves our thesis that solving contextualized problems through an ACE helps develop problem solving competences. The average score achieved in the final competition in 2015/2016 was 70/100, which is a notably high result. Almost all the participants managed to solve at least one part of the problem assigned, which was more difficult than those assigned during the training. Data about the submissions during the training reveal a lot about the progressive enhancement in problem solving skills of participants. As shown in Figure 3, the average grades achieved by students problem after problem increased, starting from 69 in the first problem and ranging up to 81.5 in the last one, while problems complexity increased as well. All the participants are skilled students in Mathematics: this allowed them to develop problem solving competences, which require the Mathematical knowledge as a background. Self-assessment of the 9 training problems is even more meaningful: students were required to do it after submitting their solutions, and it shows a similar increase. From the evaluation survey distributed at the end of the project to all the participants, it emerged that the use of the ACE and interesting problems were the features of the project which most engaged the students: the use of the ACE was considered engaging with a mean value of 4.0 (st. dev.: 1.0) and the problems with 3.8 (st. dev.: 0.8). Lastly, they considered that solving problems through an ACE was very useful for several reasons, as shown in the Table 1; their answers are compared with those of their teachers.

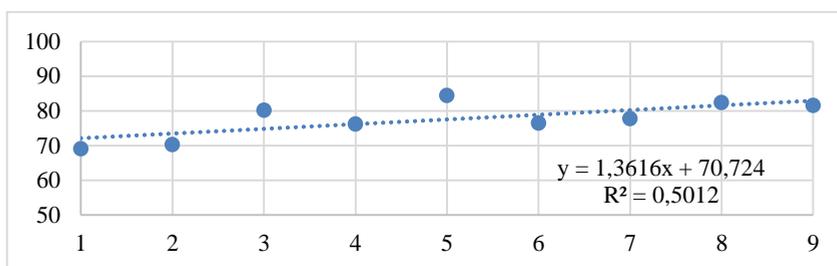


Figure 3. Average students' grades of the 9 training problems

5. Conclusions

The experience of the DMT project shows that solving contextualized problems through an ACE is a useful activity for the development of cross-cutting competences, first of all problem solving. It is important that Mathematics teachers include these kinds of activities in their classes: the teachers of the classes participating to the DMT receive a special training aimed at adopting these methodologies into their teaching. As a result, many of them started using problem solving activities with the ACE in their classes, and several of their students who didn't participate to DMT asked Maple's licenses on their computers.

The Department is particularly dedicated to this purpose and includes this methodology in several other projects aimed at teacher training. The major difficulty for teachers is their inexperience in the creation of cross-disciplinary problems: one possible solution could be to organize multidisciplinary activities or courses, with the collaboration of teachers and experts of different subjects, with the special purpose of developing problem solving skills. The new "Alternanza Scuola Lavoro", now compulsory for all Italian high schools (MIUR, 2015), provides a first answer to this request; the DMT project, for the reasons discussed above, has been proposed as an activity of Alternanza Scuola Lavoro (Barana & Marchisio, 2016).

Table 1. Usefulness of the problem solving with an ACE according to students and teachers.

	Students		Teachers	
	Average	St. Dev.	Average	St. Dev
Better understanding of some aspects of Mathematics	3.3	1.1	3.9	0.8
Deepen links between Mathematics and Informatics	3.7	1.1	4.1	0.7
Better understanding of the usefulness of Math	3.6	1.1	4.0	0.7
Acquire useful skills for school and university	3.9	0.9	4.3	0.7
Acquire skills spendable in the working world	3.7	1.1	4.0	0.9

Acknowledgment

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Teamwork: Assessment of teamwork competence in higher education

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Abstract

Teamwork is both a competence highly demanded among workers and an academic field with an extensive specialized literature. Based on this knowledge that comes from the study of organizational behavior, this communication presents a model to understand teamwork in higher education settings. The theoretical model considers structural components (i.e., task interdependence and task uncertainty), processes (i.e., team development and team climate for learning) and results (i.e., team effectiveness). Moreover, an assessment tool (and attitudinal questionnaire with 42 items-Likert scale with a range from 1 to 7) is also presented to measure these critical components that can allow us to distinguish between effective and ineffective teams in higher education. Preliminary results of the application of these tools to 18 team students show good consistency values of the scales used being able to distinguish among teams. Additionally, we propose a procedure to obtain aggregated measures per group from the members' responses considering the degree of agreement among them.

Keywords: *Teamwork; aggregated team measures; competence assessment; higher education.*

1. Introduction

Teamwork is a general competence included in the training plans of different undergraduate studies. For example, it is one of the general competences that we can see in the majority of the undergraduate studies at the University of Barcelona, where this competence is defined as the ability to collaborate with others and contribute to a common project, to collaborate in interdisciplinary teams and multi-cultural teams, and to participate in conflict resolution within the team. Additionally, teamwork is also a competence highly demanded in labor market. The reason behind this is simple: most jobs today have become jobs in which knowledge is managed. The work has ceased to be manual and has become to be related to knowledge activities and about the skills to manage it. For this, the use of a small group of workers who have to create, use or modify that knowledge is an adaptive advantage in relation to the classic designs of individual posts. A small number of people with differentiated roles has more resources (i.e., knowledge, skills) to deal with these tasks of knowledge management (e.g., Kozlowski & Bell, 2003); for this reason organizations are now referred to as multi-team systems (Zaccaro, et al., 2011).

This is also why the team science, based on disciplines such as social psychology or sociology, has experienced an important development in recent years. Now we have extensive knowledge about how to design effective work teams (e.g., Salas, 2015; West, 2012). This knowledge is regularly applied in the team training programs, especially in sectors such as health, R&D, military or sports, and it is also applied in more classic organizations dedicated to production or services (e.g., automobile industry, hotels, etc.; e.g., Meneses & Navarro, 2015).

The objectives of this research will be: 1) to apply current knowledge from team science to understand teamwork competence in higher education settings, 2) to adapt existing assessment tools to the type of teams regularly used in higher education, 3) to generate knowledge about the characteristics of effective teams of students.

2. A model to understand teamwork

For the development of teamwork competence, the attention must be paid both to psychosocial aspects (e.g., the relationships established among team members) and to specific characteristics of the task addressed by the team. Usually, this second aspect is systematically forgotten assuming that any task is possible to execute in teams and, therefore, when the performance of a team is deficient is attributed to the members that have not sufficiently developed the competence to work as a team. But this is not always the case; frequently happens that teams do not work as such for the simple reason that the

task to be tackled can be done effectively without the use of teams, in other words, without putting the teamwork competence into play.

To understand teams, team science has a pragmatic starting point: it is interested in knowing why some teams are more effective than others. What is interesting for us here is what the literature proposes about how some teams become more effective than others. This is often referred to as IPO models (inputs, processes and outputs) and IMOI models (input models, mediators, outputs and new inputs, inputs-mediators-outputs-inputs). Paying attention to these inputs and processes or mediators the literature usually repeats a series of key aspects to understand effective teams. Let us describe these in detail. We will follow the model proposed by Navarro et al. (2011; see Figure 1) adding some elements that we consider interesting taking into account the type of teams (groups of university students) as well as the context in which these take place (an academic context of learning).

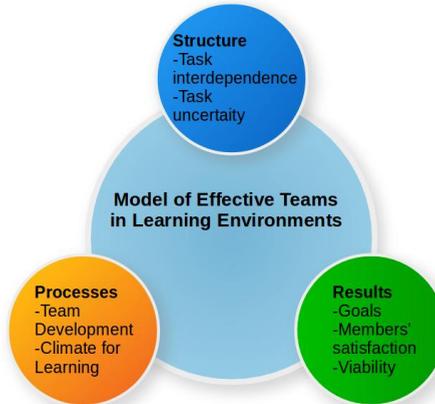


Figure 1. Model of effective teams in learning environment (adapted from Navarro et al., 2011).

2.1. Team structure

Teams are always designed to do something, to accomplish some tasks. Team tasks can have certain characteristics that require that members behave in one way or another, for example in a more or less coordinated way. Tasks are of paramount importance in designing effective teams because, as repeated research teach us (e.g., Salas et al., 2009), not all tasks require teamwork and, when this happens, teams do not work as real teams because they not need to do it. For example, if a task can be decomposed into individual subtasks whose effective implementation does not require interaction with others, teamwork will not occur and teamwork competence becomes unnecessary. In other words, teams are not always necessary and special attention must be paid to what types of tasks require a coordinate effort of members. This aspect is critical because if we are interested in

the development of teamwork competence the first thing to do is to design tasks that really require teamwork.

In this regard the literature (e.g., Gladstein, 1984, Navarro et al., 2011) consider two key aspects of the tasks: their levels of interdependence and uncertainty. Interdependence refers to the direction of the work flow that makes that team members have to interact, to a lesser or greater degree, with each other to achieve the task successfully. For its part, the uncertainty refers to the existence of unclear links between what the team has to do and what results it will get. Uncertainty is high when tasks are unclear (there are not knowledge about what to do and how), diverse, novel and there are sub-tasks that are incompatible each other. Tasks are really team tasks when both interdependence and uncertainty are high. In these conditions, a real work team is required to face with the tasks with guarantees of success.

In addition to the tasks, other structural characteristics are important, such as size or diversity. We know that size influences on team phenomena that may imply a negative influence on effectiveness. This is the case, for example, of the phenomenon called social loafing that appears more easily in large groups. And we also know that diversity introduces an added complexity to the team that has to know how to manage it. Diversity sometimes influences communication between members, making it difficult to have members with different social norms in this respect. And, on the other hand, diversity can be as well an accelerator in solving certain types of tasks, such as creative ones.

2.2. Team processes

Team science has found that there are many cognitive (e.g., mental models, transactive memory, team learning), affective (e.g., team potency, cohesion, group emotion) and behavioral processes (e.g., communication, coordination) that are important for understanding teamwork. In addition, there are also emerging processes (e.g., group development, group climate) that are also determinants of team performance. Taking into account the strength relationships previously founded in the literature (see Kozlowski & Bell, 2003) and the specific context in which we are interesting in we will choose the following processes to consider: team development and team climate for learning.

Team development refers to the maturity of the group. Not all teams reach the same level of maturity. The highly developed teams are those in which their members interact regularly, coordinate resources, orientate their behavior towards collective achievement and in which members feel identified with the team (Meneses et al., 2008). On the other hand, team climate for learning (e.g., Brodbeck et al., 2010) refers to shared perceptions within team members that promote collective learning. Within this climate of the team for learning, we

include some dimensions that we consider particularly interesting in this project, such as mutual trust among members, openness to share ideas, or equality in the exercise of influence among members.

2.3. Team effectiveness

Although there is not unanimity among authors about what should be considered team effectiveness, the normative model of Hackman (1987) is usually considered the most appropriate. According to this proposal a team is effective when it achieves three things: 1) to achieve the objectives for which it was designed; 2) to satisfy the needs of its members, and 3) to be viable or sustainable over time. If team fails in the achievement of one of these elements team is considered as ineffective.

3. Measuring the components of the model

Once we have a theoretical model useful to understand why some teams are more effective than others (i.e., because they are more developed; because their tasks are more interdependent; etc.), we can measure all of these components to obtain an assessment in team of students in higher education.

In Table 1 we present all the instruments that we have adapted here for our purposes. All of these instruments have a long tradition in team science showing good reliability and validity results in the studies that we mention as well.

Table 1. Instruments to assess the components of the model of effective teams

Component	Source	Characteristics	Example of items
Task interdependence	Van der Vegt and Janssen, 2002	7 items-Likert format	'I need information and suggestions from colleagues to do my homework well'
Task uncertainty	Navarro et al., 2011	18 items-Likert format	'We find it confusing to know what it is that we should get with our work'
Team development	Navarro et al., 2015	8 items-Likert format	'Members feel committed to meeting group goals'
Team climate for learning	Brodbeck et al, 2010	9 items-Likert format	'My group helps me in my individual learning'
Team effectiveness	Navarro et al., 2011	11 items-Likert format	'We are effective at accomplishing our tasks'

4. A first study: Main results

We have the opportunity to applied these instruments to 18 students' teams in the Bachelors degrees of Psychology and Sociology, at the University of Barcelona. When applied the tools to team of students that work in a team during certain time (i.e., a semester) to cope with an assignment put by, and assessed by as well, the professor. The main descriptive results can be found in Table 2. Additionally, in Figure 2 we represent the teams' average values in each component of the model.

Table 2. Descriptive results, and correlations, of the team model application

Variable	<i>M</i>	<i>SD</i>	min	max	1	2	3	4	5
1. Task interdependence	3.18	0.88	0	5	1				
2. Task uncertainty	3.53	0.95	0	5	0.18	1			
3. Team development	3.43	1.01	0	5	-0.03	0.48*	1		
4. Team climate for learning	3.47	0.95	0	5	-0.32	0.22	0.75**	1	
5. Team effectiveness	3.60	1.08	0	5	-0.39	0.09	0.68**	0.93**	1

Notes: N = 18 students' teams; * p < 0.05; ** p < 0.01

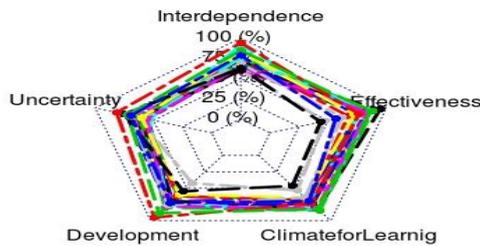


Figure 2. Average values in team model components in 18 students' teams

Team processes measured (i.e. development and climate for learning) are clearly related with team effectiveness. On the other hand, tasks measures (i.e., interdependence and uncertainty) seem to be unrelated with that effectiveness. Moreover, considering Figure 2 we can say that the instruments applied are useful to distinguish among the different students' teams.

4.1. Procedure to aggregate data

Measuring team constructs considering the perception of team members introduces a challenge in the assessment in the sense that we have to create an team aggregate measure from members' perceptions, in other words, from individual perceptions. To do this, it is needed to study previously if there is an agreement among the perception of team members.

If this happen, we can obtain a reliable aggregated measure of the team (e.g., the mean or median values among individual perceptions).

To study this agreement we recommend follow the suggestions made by Bliese (2000) and to apply the intraclass correlation coefficients (ICC) or, alternatively, the average mean/median deviation index (AMD). Bliese provides guidelines about how to calculate and interpret both measures in team studies. In the application showed before all the teams obtained ICC values that indicated agreement. But, in other applications, when agreement does not happen it would be relevant to study the causes of this disagreement and to study as well the possibility of the existence of different subgroups inside each team.

5. Conclusions and future direction

Teamwork competence is so relevant nowadays in academic and labor settings. Being able to measure how well the students work in teams is the first step after study if this competence is developing over the years in which the students are in our universities. At this point, the use of assessment in different waves (e.g., one per semester) doing a follow up study with the same students can be very useful to understand how team competence evolve over time, and to check if as professor we really achieve that our students learn how to work in teams. Moreover, if we focus on competences development, we must have tools to assess these competences properly.

The next step for this research can be twofold. First, to convert the tools in a possible rubric than can be apply by an observant of the team in real time. This means to create an observational system than can be used for observers (e.g. the professor) to assess a team of students while they are working together (e.g., making a public presentation). And second, to study if, as we guess, students' teams that are more effective have, at the same time, better results in terms of academic performance (e.g. better final marks).

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Enhance, Extend, Empower: Understanding Faculty Use of E-Learning Technologies

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Abstract

There has been scant nation-wide assessment of institutional use of learning technology in Canada (Grant, 2016) and where assessment has been done of student access to e-resources, considerable variability within and across institutions has been reported (Kaznowska, Rogers, & Usher, 2011). With a broad vision of improved and increased use of learning technologies, one university wanted to explore the use of e-learning technologies across campus. The purpose of this study was to identify instructors' needs and aspirations with respect to how learning technologies at the university could be designed, implemented, and supported. The 3E framework of Enhance, Extend, Empower, proposed by Smyth, Bruce, Fotheringham, & Mainka (2011), was useful in examining the underlying purposes of using e-learning technologies. For this qualitative study, the research team engaged 32 instructors in individual interviews or in focus groups to discuss how they currently use e-learning technologies, how they hope to advance their uses of these technologies, and their perceived barriers or enablers to implementation. The study has implications for practice and policy at postsecondary institutions; additionally, this study suggests possibilities for further research into the scholarship of teaching and learning in the context of e-learning technologies.

Keywords: *E-learning technologies, postsecondary, scholarship of teaching,*

1. Introduction and Background to the Project

“Learning technology is the broad range of communication, information and related technologies that can be used to support learning, teaching, and assessment.” (Association for Learning Technology, 2016, para. 1).

The key needs for embracing learning technologies have been echoed in National fora where the importance of students’ ability to use digital technology to “access, evaluate, create and communicate information” are seen as central to their academic and professional success (Universities Canada, 2016, p. 4).

The use of learning technologies is identified as moderate and inconsistent at the university that was the focus of this research, based on available metrics (e.g. Blackboard log-ins). There has been scant nation-wide assessment of institutional use of learning technology (Grant, 2016) and where assessment has been completed of student access to e-resources, considerable variability within and across institutions has been reported (Kaznowska, Rogers, & Usher, 2011).

With a broad goal of improved and increased use of learning technologies, an institutional committee identified that a range of concerns and opportunities needed to be better understood in order to identify required supports, infrastructure, and policy. Given this need, a project was undertaken in the 2015-2016 academic year to identify instructors’ needs and aspirations with respect to ways that learning technologies at the university could be designed, implemented, and supported. A university sanctioned steering committee engaged a smaller working group of four academic researchers, and then guided and supported the work of the project.

1.1. Research Questions

As directed by the institutional committee of teaching and learning, the researchers wanted to better understand the concerns and opportunities of instructors regarding e-learning technologies in order to identify required supports, infrastructure, and policy. For this purpose, these research questions were established:

- (1) How do instructors currently use learning technology in their teaching practice?
- (2) How do instructors envision learning technology supporting their future teaching practice?
- (3) What are the barriers to their use of learning technology?
- (4) What enables their use of learning technology?

1.2. Conceptual Framework: 3E Framework (Smyth, Bruce, Fotheringham, & Mainka, 2011)

Three broad uses of technology, existing on a continuum, provided a useful framework for this research project. The uses are defined by the types of learning they enable. An underlying assumption of both this continuum and this research project is that it is possible to use technologies to benefit teaching and learning. The uses of technology will vary, including but not limited to uses that: create efficiencies, improve accessibility and/or timing, encourage enriching interaction, and foster development of key skills, abilities, and literacies (Laurillard, 2002). The 3E Framework, designed and developed by Smyth et al. (2011) from Edinburgh Napier University, is presented in Figure 1.

A range of learning tasks and activities can align with any of the three levels within the 3E Framework – meaning that these categories are not clearly distinct. A blending may be commonplace in practice, especially between the *enhance* and *extend* levels.

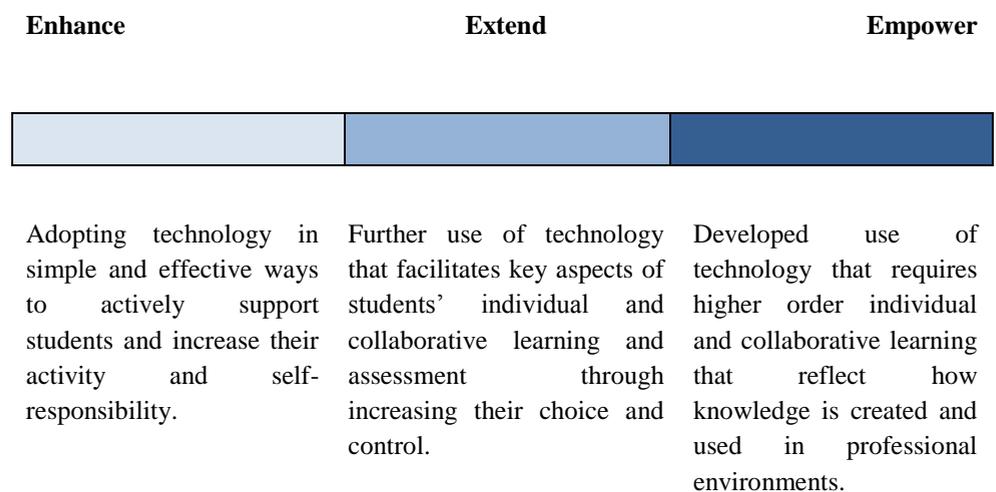


Figure 1: 3E Framework (adapted from Smyth, Bruce, Fotheringham, & Mainka, 2011, p. 3)

It is important to note that the 3E Framework does not promote the empower level as an ideal; in fact it may work less well in some subjects, whereas enhance is regarded as working well in any subject at any level of study.

2. Method

To follow the direction and intent of the institutional steering committee, and to answer the research questions, a qualitative approach was utilized for the research. Because of the moderate and inconsistent use of learning technologies understood to exist at this campus, it was necessary to delve into instructor perspectives, needs, and concerns by being able to probe and discuss at some length the opportunities and issues with the use of technology in supporting their pedagogic goals. Thus, a qualitative case study approach (Creswell, 2014; Merriam & Tisdell, 2015) was used because the team wanted to examine one institution's e-learning environment in-depth, incorporating the perspectives of multiple instructors.

2.1 Sample

To set the conditions for rich discussion, it was decided that the data collection would occur using semi-structured interviews of instructors conducted in pairs or groups of three. Where schedules did not permit a paired or grouped interview, individual interviews were conducted. In total, eight grouped interviews were conducted from January to May 2016, along with eleven interviews, for a total of thirty-two instructors participating, from twelve colleges and schools.

The term "instructor" was chosen and used in this report to be inclusive of faculty and sessional instructors; the terms faculty and sessional are used in this report only where it was felt necessary to contextualize the findings. Instructors were individually identified as potential participants by the project team and by referral from invited participants. The team sought diversity with respect to disciplinary area, stage of career, and in particular the type of learning enabled by technologies using the 3E Framework of enhance, extend, and empower. Given the limits of the researchers' networks, there were surely instructors using learning technologies who were not identified as potential participants and whose points of view may be missing from this research project.

As expected, it was easiest to identify instructors at the enhance level where students were supported in their learning activity and self-responsibility by the use of technology. There were also many using learning technologies at the extend level where students' collaborative learning, choice, and control were increased through the use of technology. Empower, where higher order individual and collaborative learning reflects how knowledge is created and used in professional environments, proved to be the level of use by instructors most difficult to locate. Here, again, given the limits of internal researcher networks and inability to discern this particular level of use, potential participants may have been left out.

2.2 Interviews

The research team collaboratively developed the interview questions, and potential participants were contacted. One team member conducted all the interviews which were transcribed by a campus research lab. Questions focused on interests or opportunities that facilitated engagement with learning technologies, concerns or challenges encountered, types of technologies used, and perceived benefits of using learning technologies. The research team then used the software package NVivo to collaboratively analyze the data, determining themes and subthemes, comparing and contrasting codes (Saldaña, 2013).

3. Results and Discussion

The findings are organized into four thematic sections, with regard to why instructors use learning technology, how they use these technologies, what enables their use of learning technologies, and what institutional supports facilitate this use.

3.1 Why do we use learning technology?

Almost all participants reported selecting and using learning technology based on pedagogic goals. These choices ranged from providing better access to, clearer communication about, and stronger engagement with, content. In-class use provided a means of breaking up periods of content delivery. Use was also noted as driven by the desire to enable active learning and discussion in class as well as to provide timely and regular formative feedback to students to support learning. More experienced technology users discussed tools that they implemented to facilitate student collaboration, sharing, and peer-to-peer feedback. In addition, more experienced users reported providing student controlled spaces where they could support their own and peers' learning (Skype, Webex, Google docs, Blackboard email). A small portion of participants used technology to empower students as content creators through tools like Mahara, blogs, social media, and Google docs. Technology also met several needs in student assessment ranging from use for student self and peer assessment, before or in class quizzes, online exams, and facilitation of reflective practice. A small number of instructors also reported using technology to support evaluation of their teaching.

In addition to pedagogically focused motivations for use of technology, several instructors also noted a desire to meet the needs of current students and, to a certain extent, match their expectations of a 21st century education. There was a sense of urgency noted by some who suggested that students would go elsewhere to study and learn if technology was not used and if the environment or teaching approach was seen to be antiquated.

A recurring theme from the data was the need for increased capacity for learning technologies to be compatible with instructors' teaching philosophies and with students' learning styles. Instructors were not suggesting that there was a "right" way to utilize

learning technology, rather the use needed to fit the learning outcomes, the philosophy of the instructor, and the needs of the particular student group.

Learning technologies were also noted as enabling flexibility and accessibility to meet the needs of an increasingly diverse student population. Many instructors stressed the importance of students being able to learn where they live and access content and learning experiences at times and locations that suited them. Flexibility and accessibility were noted as particularly important for students who had responsibilities for caring for others, who were working and studying, and who would benefit from easy and repeated access to course materials (e.g. for students with English as an additional language). The affordance of technology to help organize and provide access to extensive content was of value in courses that were perceived to be content heavy.

While there was general enthusiasm amongst this group for use of learning technology, there were cautions around it ever completely replacing face-to-face interactions. From almost all participants, learning technology was seen to compliment rather than take the place of face-to-face interactions with and among students.

To summarize, the overriding motivation for instructors to use technology in their teaching was to support achievement of student learning. Technology was reported as improving engagement, enhancing student connections to content and each other, and improving opportunities for communication amongst the class. Also mentioned were the flexibility and engagement that technology affords and the potential for collaborative learning. For a smaller proportion of participants, perhaps influenced by the type of teaching undertaken, technology was seen to allow students to be more independent in their learning and enable a shift from students as content consumers to content creators. This shift is in line with the student as producer pedagogical model where students are collaborators in the production of knowledge and, like researchers, share their outputs beyond their immediate instructor (Neary & Winn, 2009). The potential for technology to enable this type of conceptual and practical pedagogic shift is significant (for example see: Kleefeld & Rattray, 2016; London School of Economics, 2016).

3.2. What tools do we use? To what end?

While the pedagogic needs and aspirations were foregrounded by participants there were many references to a variety of learning technology tools employed in teaching practices. Some of these were references to particular tools (e.g. Blackboard learning management system), some were more broadly references to a particular medium of delivery or engagement (e.g. video). Overall, the request for tools that were intuitive and easy to use was central to the findings.

Participants identified a range of general and specific tools that they use to support their teaching and students' learning. Video was the most widely reported and used technology for instructors regardless of their experience in the classroom. Some were using existing video resources while others were creating their own materials. Video also impacted pedagogy with the structuring of courses (such as flipping the classroom or lecture capture) or use of video as a communication tool for remote students. Blackboard, despite its noted faults, was made to work by a large number of participants to deliver course material and provide a place for students to interact. Student response systems were integrated by many for a range of purposes (attendance, clarity of lecture, assessment).

There were a number of tools that were not pervasive but piqued the interest of some instructors. The potential for use of tools like Mahara, blogs, Twitter, or Facebook to facilitate reflection and build a portfolio of practice to be shared with others was seen as significant but not by a large number of participants. Overall interest in tools that enable student collaboration, particularly student "controlled" spaces, was also of interest.

Guidance and support in use of third party/web based tools was noted frequently as was the need for careful consideration of use of resources provided by textbook manufacturers. Use of technology to facilitate peer feedback was an area that some identified as worthy of further exploration. As instructors struggle to look into the future given the rapid changing of learning technology, it was noted that the institution needs to be agile in the provision of learning technology infrastructure and support in its use.

3.3. How does/could support enable our use?

Participants noted that when they first engaged in learning technology use, they began doing so by working alone and in isolation. As they became more comfortable in technology use, they began to seek out supports available and connections to others engaged in similar practices. The reported experience of not feeling able to seek help initially is one that bears further exploration to see if it is pervasive. If this phenomenon proves to be widespread, strategies to provide direct support to individuals will be important to ensure their initial activities are relatively positive ones that engender a desire to continue to develop these practices

It was implicit in many of the participant statements that the choice or selection of technology depended to a great extent on the values and beliefs of the instructor. As noted in an earlier section, the instructor needs to believe that using technology will improve the teaching and learning environment before an effort will be made to engage with its use. Participants were particularly drawn to technology that empowers students and instructors, creates communities, fosters communication, streamlines processes, and/or promotes collaboration.

The call to bring more awareness and interest to the technology available at the university needs to be considered carefully, however. The importance of local and disciplinary practices in relation to learning technology use should not be overlooked. The potential for support to be provided to active technology users to explore practices that fit with the needs and pedagogical aspirations of a program, department or college is great and shouldn't be lost in the desire to provide institution wide solutions. This approach would also enable what several participants called the opportunity to "blue sky" with colleagues wanting to achieve similar outcomes. While central units were noted as an important support, the call for innovation was largely about fostering dedicated time and space for innovative thinking with colleagues. Capitalizing on innovators to collaborate, generate ideas, lead, and share practices relevant to disciplinary and departmental cultures is in line with understandings of effective strategies to support technology adoption (Rogers, 2003).

Overall, consistent institutional support was seen to be important by participants regardless of location, setting, building, or program. Consistent support across sites and colleges was described as needing to include professional development, Information, Communications, and Technology (ICT) incident response, and release time or other similar supports for instructors willing to trial a new technology. Establishing mentorship relationships between instructors with different skill levels was described as a significant enabler of adoption. There was a clear call for the provision of time and space for experienced technology users to imagine, plan and implement new strategies individually and collaboratively. Creation of a supportive learning technology user community was seen as an essential element. Some participants also called for consideration of student digital literacy development. Where this development would best be undertaken (e.g. within and/or outside the formal curriculum) needs further consideration.

3.4. How do institutional and local resources and rules shape our use?

The decision to begin using learning technologies is made by individuals influenced to varying degrees by the culture, common practices and structures they encounter (e.g. facilities, policies), and who feel more or less willing to act depending on the characteristics and perceived benefits of the innovation they are considering (Rogers, 2003). Participants noted many factors that influenced their or their colleagues' adoption of technology to support student learning.

Many participants noted that more pervasively available, appropriate, and reliable facilities would support in class use of technology. Relatedly, reliable and immediately available support for use of classroom technology was seen as essential. The perception that the institution favours enterprise tools like Blackboard and discourages use of third party tools was seen to be a barrier to use by many, particularly in regard to new and innovative applications or tools used in other contexts (e.g. Google) selected to meet particular needs.

The perceived lack of flexibility in the scheduling of teaching and the lack of openness to approaches that counter the typical teaching timetable were also seen as barriers to use of technology. Echoing findings noted earlier, the lack of time for meaningful engagement in learning about, planning for, and implementing use of learning technologies was noted by many.

Perceived privileging of research over teaching by the institution was also noted as a problem, somewhat offset by a sense that their college or department did value good teaching practices. Participants noted a clear vision for learning technology use by the institution, perhaps framed by the question, “What problem does technology help us to solve?” would be useful to inspire increased adoption.

4. Conclusions

The findings outlined above, considered in the context of scholarship in this field, led to a set of recommendations to improve and meaningfully increase use of learning technologies at this university. However, other campuses may consider these recommendations helpful in examining their own practices, and further promoting use of e-learning technologies at their own institutions.

4.1 Implications for Policy and Practice

The institution can offer the necessary infrastructure through developing a strategy and subsequent roadmap for an ecosystem of teaching and learning applications. The ecosystem, integrated by a central learning management system, would reflect the principles and desires identified in this research: a) interfaces that are intuitive and easy to navigate b) increased availability of video tools c) provision of student owned spaces online d) increased tools for communication, collaboration, and reflection e) tools that foreground accessibility, and f) connection to tools hosted outside the institution. Other changes to institutional practices could better facilitate the development of e-learning technologies. These recommendations include developing and implementing strategies to cultivate local learning technology innovators and support them in imagining, sharing, implementing, and leading. Similarly, student capacity to use e-learning technologies needs to be facilitated either through co-curricular offerings, in-class or tutorial support, or programmatic inclusion of e-learning technology skills. Most importantly, learning technology must become integrated explicitly into the teaching quality framework of the institution, including recognition for teaching innovation and use of emergent strategies. The institution needs to incorporate e-learning technology into its priorities through strategic planning processes.

4.2. Implications for Research and Future Scholarship

This study used the 3E framework proposed by Smyth, et al. (2011), to initially establish categories of expertise in using e-learning technologies and to suggest codes or themes regarding objectives for implementing these technologies. While the framework was helpful in examining how instructors used technology, it was perhaps a less useful lens to view the institutional environment that can either impede or facilitate use of these e-learning tools and techniques. Employing a policy analysis framework in future studies may be useful for further examining the dynamic of institutional expectations, supports, and strategic positioning in promoting a teaching and learning environment that incorporates e-learning technologies.

Furthermore, ongoing research regarding best practices for supporting development of e-learning technologies would be helpful to explore potentially beneficial practices such as developing communities of practice among instructors. Additionally, student success in relation to the introduction of particular technologies would help develop the persuasive case to invest institutional resources for supporting the implementation of e-learning and for the recognition of excellent teaching.

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Practise makes perfect: developing critical thinking and effective writing skills in undergraduate science students

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Abstract

Successful undergraduate students are required to demonstrate critical thinking and effective writing skills in their final year project dissertation, but the early years of some science degree programmes may not fully prepare them for this challenge. This study investigated the value of earlier engagement with scientific literacy skills by assessing the impact of rehearsing critical thinking and extended scientific writing tasks earlier in the degree programme. This paper reports a small-scale case study of a single cohort of students on B.Sc. (Hons.) Biomedical Sciences degree schemes at a research intensive university and describes quantitative analysis of students' performance in two research-driven writing tasks at different stages of the degree: a literature review in Year 2 and a research dissertation in the final year. The results of this study support the concept that earlier exposure to extended writing tasks requiring scientific literacy skills is beneficial for students whose final year project has a similar literature-based format; the experience of completing the literature review appears particularly valuable in improving the academic performance of weaker students.

Keywords: *scientific literacy; undergraduate; bioscience; writing; dissertation; practice*

1. Introduction

Most undergraduate students are expected to write a dissertation during the final year of their degree programme; the perceived pedagogic value of this task encompasses development of independent learning characteristics that require deep learning approaches. A student's successful demonstration of higher-order cognitive skills (such as critical evaluation and synthesis of ideas) is embedded in, and evidenced by, their written dissertation. For science students, in particular, the final year dissertation may represent the longest and most complex piece of writing they undertake during their undergraduate degree. Scientific literacy encompasses skills of interpreting, evaluating and communicating scientific evidence; such skills are recognised as important attributes by employers, course tutors and students alike. Bioscience employers rate 'written communication' above other general skills, including numeracy and other core skills (Saunders & Zuzel, 2010) and course tutors recognise scientific and critical analytical writing skills as important outcome measures for Life Sciences degrees (Rosenfeld, Courtney & Fowles, 2004; Marbach-Ad & Aviv-Elyashiv, 2005). Biosciences students themselves also perceive effective writing to be an important component of their skill set; however, diagnostic tests in early years at university indicate that the writing skills of the undergraduate Biosciences student population are weak (Marbach-Ad & Aviv-Elyashiv 2005; Jones, 2011). The reduced emphasis on extended writing in the school curriculum and, increasingly, in the early stages of undergraduate degree programmes mean that writing opportunities may be limited (Kellogg & Whiteford, 2009), so students may be unprepared for extended writing tasks.

Inquiry-based learning activities, such as literature reviews and research projects, can improve undergraduate students' scientific literacy (Gormally *et al.*, 2009) and such extended writing tasks can develop deeper approaches to learning (James, 1998). The specific aim of this study was to investigate the impact of undertaking an extended scientific writing task at an earlier stage of the degree programme; this task offers students prior experience of many of the advanced critical thinking and scientific writing skills that are important for success in the final-year research dissertation.

2. Methods

A small-scale case study of a single cohort of undergraduate students on B.Sc. (Hons.) Biomedical Sciences degree schemes was undertaken at a research-intensive University in the U.K. Data were collected relating to two modules assessed primarily through production of an extended written report. 32 students on Biomedical Schemes completed both a literature review module (Regulated Qualifications Framework (RQF) level 5) in the second year of their degree and the project dissertation (RQF level 6) in the final year of their degree (module details in Table 1). Individual students' prior writing experience was not considered, although all students had a common learning experience in the first year of their degree schemes.

Table 1. Details of the two modules forming the focus of this study

Module name	LITERATURE REVIEW	PROJECT DISSERTATION
RQF level	5 (Year 2)	6 (Final Year)
Report word limit	4000 words	7000 words
Module weighting	20 credits 8.3% of year 2 1.7% of final degree overall	40 credits 25% of final year 20% of final degree overall

Academic performance data from the literature review module and the final-year project dissertation module were compared. The final-year project dissertations reported practical or library-based research activities. Projects were allocated according to students' choice and academic performance; only those students with a weighted average mark >52% at level 5 were allocated a practical project, although students above this standard could undertake a literature-based project if they so wished. The same cohort of 32 students completed the literature review module and the final-year project dissertation module; of these, 13 completed literature-based projects and 19 completed practical projects. The marking criteria for both modules addressed the students ability to discuss and critically evaluate the research evidence (generating a component mark for the student's interaction with their supervisor) and to present their thoughts and arguments lucidly and concisely in written form (generating a component mark for the written report).

Descriptive statistics demonstrated that all data sets were normally distributed, so standard parametric tests (paired or unpaired Students t-tests, as appropriate) were used to test for significant differences between groups.

3. Results and Discussion

When both practical and literature-based research projects were considered together, there was no significant difference in the average performance for the literature review module and the final year dissertation modules (Table 2; $p > 0.1$, paired t-test, $n = 32$). Furthermore, when the written report components of these modules were considered alone, the average marks were similar ($64.1 \pm 7.9\%$ *c.f.* $64.3 \pm 8.2\%$; $p > 0.1$, paired t-test), confirming that effects on other assessment components had not masked any potential improvement in writing skills. This initial result is surprising, as regular reading and writing tasks have been shown to improve science students' academic literacy (Parkinson *et al.*, 2008) and tutor feedback has been suggested to aid development of academic writing skills (Court, 2014). Separate comparisons of marks in relation to practical and library-based projects, however, revealed some interesting differences (Table 2).

Table 2: Comparison of the same students' performance in the Year 2 Dissertation module and the Final Year Project module.

	Mean mark (%)	\pm standard deviation	Range (%)	Paired t-test
ALL PROJECTS ($n = 32$)				
Yr 2 literature review	64.4	8.2	46.6 – 75.3	$p > 0.05$
Final year project	66.5	8.8	45.1 – 80.3	(n.s.)
LITERATURE-BASED PROJECTS ($n = 13$)				
Yr 2 literature review	57.2	7.3	46.6 – 70.7	$p < 0.02$
Final year project	65.0	6.9	49.3 – 78.7	
PRACTICAL PROJECTS ($n = 19$)				
Yr 2 literature review	68.5	5.9	57.3 – 74.8	$p > 0.05$
Final year project	67.5	9.3	45.1 – 80.3	(n.s.)

41% (13/32) of students who completed the literature review module in Year 2 also undertook a library-based project in their final year. The average academic performance of these students was significantly weaker than those doing practical projects (Table 2). The average Yr 2 literature review mark for students who went on to complete a practical project was $68.5 \pm 5.9\%$ ($n = 19$), compared to $57.2 \pm 7.3\%$ ($n = 13$) for students who went on to complete a library project ($p < 0.02$; unpaired t-test). This finding might be expected, since students with lower academic performances in Year 2 were constrained to undertake library-based projects in the final year of their degree. However, the performance of these students recovered in the final year, so that there was no significant difference between the average marks for practical and library-based project dissertations (Table 2; $p > 0.1$; unpaired t-test). These data reveal a clear improvement in this group's performance in the

second extended writing task *i.e.* the final year project dissertation. The performance improved from $57.2 \pm 7.3\%$ ($n=13$) in the Year 2 module, to $65.0 \pm 6.9\%$ in the final year project module (Table 3). This significant increase in the average mark for the project ($p < 0.02$, paired t-test) represents an average improvement of 6.6%. This improved performance supports the proposal that progressive tasks requiring the same set of skills allow students to hone their skills (James, 1998), and that this may be particularly beneficial for weaker students.

Table 3: Comparison of the overall performance of students who completed literature-based final year projects and their marks for individual components of the modules ($n=13$).

	Mean mark (%)	\pm standard deviation	Range (%)	Paired t-test
FINAL LITERATURE-BASED PROJECT MARK OVERALL				
Yr 2 literature review	57.2	7.3	46.6 – 70.7	p<0.05
Final year project	65.0	6.9	49.3 - 78.7	
MARK FOR WRITTEN REPORT COMPONENT				
Yr 2 literature review	58.1	6.7	46.3 – 70.0	p<0.05
Final year project	64.2	9.5	53.0 – 82.1	
MARK FOR INTERACTION WITH SUPERVISOR				
Yr 2 literature review	58.2	11.7	44.0 – 78.0	p<0.05
Final year project	69.0	10.9	52.8 - 88.0	

The final mark of both modules was composed of independent marks for the written report component and the supervisor's assessment of the students ability to participate in discussion and critical evaluation of the research topic. Considering the written report component of the assessments only, there was also a significant improvement in these students' marks between the two writing tasks (Table 3; $p < 0.05$, paired t-test); the average mark increased from $58.1 \pm 6.7\%$ to $64.2 \pm 9.5\%$, with an average improvement of 6.1%. It has been shown previously that weaker students are most likely to benefit from practising scientific literacy skills (Parkinson *et al.*, 2008), and that repetition of contextual writing tasks can be particularly beneficial to weaker students (Johnstone *et al.*, 2002). However, this improvement in the written component does not solely explain the increased module mark overall. The average marks for the supervisors' assessment of students' ability to participate in critical discussions also increased significantly (from $58.2 \pm 11.7\%$ to $69.0 \pm 10.9\%$; $p < 0.05$, paired t-test) between the two modules (Table 3). Tutor marks have been shown to correlate positively with evidence of deeper approaches to learning, including critical thinking / analytical inquiry (Cassidy, 2006). More direct assessment of such skills remains complex and challenging (Liu *et al.*, 2014), but these data suggest a key role of the tutor in developing critical thinking skills of weaker students, in particular.

Students who chose practical projects achieved similar average marks in their literature review module and the project dissertation (Table 2; $p > 0.1$, paired t-test). Similarly, there was no difference in the mark for the written component alone ($p > 0.1$, paired t-test). In contrast to the students undertaking literature-based projects, these data do not demonstrate any clear improvement in performance following completion of the literature review module in Year 2; there are a number of possible explanations for this. Students undertaking the practical project tended to have a better final mark in the literature review module (Table 2; $p < 0.05$, unpaired t-test), suggesting that these students may have refined their deep learning and writing skills during this Year 2 module, before starting their final year project module, so that no further improvement was apparent. Alternatively, since the practical projects also require students to develop specialised experimental techniques and data analysis skills, these students may fail to apply their skills in this different context (Stefani *et al.*, 1997; Scott, 2005). It should also be acknowledged that multiple complex factors, including motivation, competitiveness and mastery goals, may contribute to an individual's performance in assessments of higher learning (Harackiewicz *et al.*, 2002), and that these influences may not be equal in both groups of students.

4. Conclusions

The results of this small-scale study support the concept that earlier exposure to tasks requiring advanced scientific literacy skills benefits those students whose final year research project activities closely model the template of a literature review; the experience of rehearsing these skills appears particularly valuable in improving the academic performance of weaker students. These findings provide the foundation for a more extensive longitudinal study of progression through the full degree programme; this would allow deeper insight into the ways that extended writing tasks foster higher-order cognitive skills, and more comprehensive evaluation of the relative benefits to different sub-sets of the student population. Furthermore, the central role of the tutor in this academic process should also be recognised, and it would be useful to evaluate in more detail the contribution of individual student-tutor interactions in academic tasks requiring problem-solving, critical thinking and effective writing. Information from these studies is likely to further demonstrate the value of including tutor-led extended scientific writing tasks at all stages of the degree programme; however it should be recognised that the pressures of increasing student numbers (and associated reductions in staff-student ratios) may challenge the provision of such individualised, interactive learning experiences.

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Critical analysis and digital literacy in learning social psychology

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Abstract

This paper presents a teaching experience in social psychology learning, aimed at students' acquisition of critical analysis and digital literacy competences at the University of Barcelona. The methodology consisted of asking each student to answer to a socially relevant question, by means of (a) identifying key underlying psychosocial processes and (b) searching for adequate keywords in scientific databases such as PsycNet and Sociological Abstracts, in order to (c) select and critically compare two relevant articles that could answer this question. The acquisition of these competences was assessed with a rubric and related questions in the final exam. Results indicated both the effectiveness of this approach to teach competences in digital literacy and critical analysis through motivating questions, and the translation of these competences in other situations. This approach also showed to be more effective in teaching these competences than only giving lectures. This methodology is promising, as it provides an answer to how to give future professionals competences in answering effectively and rigorously to socially relevant problems in the Information Society.

Keywords: *Critical Analysis; Digital Literacy; Psychology teaching; Motivation; Database usage.*

1. Introduction

The acquisition of competences in Critical Analysis (CA) and Digital Literacy (DL) is crucial to work efficiently within the innovation, growth, and social development processes of the Information Society (European Commission, 2016). Higher education has a decisive role in promoting these competences (De Pablos, 2010), as a key agent to teach future professionals how to answer relevant questions for their professional areas, dealing effectively with the exponential increase of available information (Verstak et al., 2014). Nowadays, one of the aims of higher education in social psychology is to give competences in DL and CA to future professionals (Agència per a la Qualitat del Sistema Universitari de Catalunya, 2005). These professional competences are necessary to answer in a rigorous and empirically-grounded way to relevant psychosocial issues such as addictions, social inequality and intercultural and gender conflicts. In this aim, following the principles of self-determination theory (Deci & Ryan, 1985, 2000), it is fundamental to contemplate the basic needs of the students, regarding their need for perceived control of what they are doing, their independence, autonomy, and self-reliance—all of them being central aspects for student's motivation (Arnone, Reynolds, & Marshall, 2009; Niemiec & Ryan, 2009), and classroom management (Babad, 2009).

In relation to these competences, it is usual to work on them independently (e.g. Corral et al., 2015), but it is crucial to work on both competences at the same time, so as to promote the efficiency of the training. The aim of this paper is to present an experience that combines the development of both DL and CA in learning social psychology. This experience corresponds to a 1st-year course during the 2nd semester, and it is framed in two on-going projects in teaching innovation at the Faculty of Psychology at the University of Barcelona, which aim to foster these competences in university students during their formation in the degree of psychology. The experience presented here made the students face the task of giving an answer to a question related to current and socially-relevant issues (e.g., the possible influence of videogames on aggressive cognitions). In order to do so, they followed these steps: first, to identify the most appropriate keywords reflecting the underlying psychosocial processes of the issue; second, to use those keywords when looking for articles in two scientific databases (i.e. PsycNET and Sociological Abstracts); thirdly, to use critical and justified criteria to select one article from each database; and lastly, to compare these articles focusing on how the answer they give to the question is complementary, opposed, or converging. Students had to report each step of the process in a paper (around 15 pages), and then they had to make a brief oral presentation (around 10 minutes) to explain their findings to their fellow students. In the next sections, the context and structure of this work is explained. After, its efficacy was evaluated according to the marks obtained by the students at the end of the project, and their ability to respond to specific questions related to CA and DL in the final exam.

2. Methodology

2.1. Participants

This project took place in a group of 200 students (158 women and 42 men) in a compulsory course in social psychology, during the second semester of the first year in the degree of psychology, at the Faculty of Psychology at the University of Barcelona, from February to May of 2016. Students gave their consent for the use of the data.

2.2. Databases

The scientific databases used by the students during this experience were PsycNET and Sociological Abstracts. Both of them contain academic publications. PsycNET focuses on psychology and related subareas, while Sociological Abstracts's standpoint is sociology. Given the nature of social psychology, and the importance of both disciplines for this area (Codina, 1997; Munne, 1997), it is relevant that the students can search efficiently in any of these databases to give a comprehensive and rich answer.

2.3. Procedure

Regarding the structure of the work sessions, during the first session, students were introduced to the objective of this project, the rubric that would be used to assess their performance, and the searching process. During the following two weeks, they had to organize themselves in workteams from 3 to 8 persons each, and each group had to choose a question related to a key social issue from a list previously elaborated by the teachers. This question was a proxy to make students rethink a social issue in psychosocial terms (e.g. attitude change, persuasion, prejudices, or dehumanization), and then the group identified the corresponding keywords to use in their search in PsycNET and Sociological Abstracts. In the second session, the teacher worked on their search results, giving general tips and tools on how to refine their searches (e.g. filters and Booleans), reviewing their keywords, and resolving other additional problems related to how they selected and interpreted the articles. In the following four weeks, they elaborated their written assignment. Two teachers involved directly in the design and evaluation of the project supervised online through e-mails, and presentially through individualized sessions under request. After sending their written assignment, students were given training in oral presentation skills, and after a month they defended their searching process and results in front of the class.

Written assignment structure consisted of 3 sections. In the first section (i.e. introduction), students summarized their searching process, the articles that they found, and the main conclusions they derived. In the second section, students detailed every step of the searching and analysis process. That is, how they identified each keyword and which filters

were applied for the search, which articles they specified and why, and how each article separately contributed to answer the question. In the third and last section, students compared the two articles and discussed about how they answer altogether to the question. Regarding oral presentations, students were expected to explain briefly their searching process, while focusing specifically on the comparison of the two articles and how they let them answer to their question.

2.4. Evaluation

Evaluation consisted of a rubric (see Table 1 in the next section) corresponding to the different parts of the assignment (i.e. identifying keywords, searching appropriately in the databases, selecting one article in each of them, and comparing these two articles to answer the socially relevant question selected in the beginning). The marks in this rubric were given according to their performance both in the writing assignment and in the oral presentation. In each item of the rubric, marks ranged from 0 to 2, according to how the students met the criteria (0= Not at all; 1= Partially; 2= Totally).

3. Findings

37 works were marked, with a $M = 7.67$ ($SD = 1.77$). 33 of them were approved, with a mean of 8.11 ($SD = 1.31$). These marks were obtained using the aforementioned rubric. As it is shown in Table 1, students showed proficiency in every aspect evaluated in the rubric. It needs to be underscored their competence in searching and analysing the articles, and justifying each step they took in the process. The aspect that they had slightly more difficulties with was assessing the strength and weaknesses of using PsycNET and Sociological Abstracts.

Table 1. Rubric and marks.

Criteria	Weight (out of 2)	<i>Mdn</i>	<i>M</i>	<i>SD</i>
1. Formal aspects (i.e. text structure, orthography, and APA style formatting)	0.25	3	2.7	0.7
2. Introduction: objective, search terms and method are explained briefly and concisely	0.25	2	1.5	0.6
3. Search and analysis	0.5*2	—	—	—
3.1. Information in summary tables is properly explained and justified (i.e. keywords' selection, decision processes, and screenshots)		—	—	—

3.1.1. PsycNET	2	1.5	0.6
3.1.2. Sociological Abstracts	2	1.7	0.5
3.2. Summary table contains requested information (i.e. authors, total publications per year, authors' publications per year)	—	—	—
3.2.1. PsycNET	2	1.6	0.6
3.2.2. Sociological Abstracts	2	1.6	0.7
3.3. The article selection process is explained and follows established criteria (i.e. its recence, number of publications of the author, times cited).	—	—	—
3.3.1. PsycNET	2	1.6	0.6
3.3.2. Sociological Abstracts	2	1.5	0.6
3.4. Article is analysed comparing students's hypothesis and article results.	—	—	—
3.4.1. PsycNET	2	1.5	0.5
3.4.2. Sociological Abstracts	2	1.6	0.6
3.5. Strenght and weaknesses of the process are detected.	—	—	—
3.5.1. PsycNET	1	1.2	0.8
3.5.2. Sociological Abstracts	2	1.4	0.8
4. Comparative analysis	0.5	—	—
4.1. Differences and similarities between results are described and analyzed (authors, number of articles, publication years, and total of cites)	2	1.6	0.6
4.2. Pros and cons of each database are described according to their adequacy to deepen on the topic of interest.	2	1.6	0.6
4.3. Articles are critically compared according to their differences and similarities in answering their hypothesis on the topic of interest.	2	1.6	0.6

The impact of this training was evaluated using a set of 5 questions in the final exam. In these questions, the student had to indicate the correct answer to different aspects related to the assignment, such as the usage of Booleans, differences between PsycInfo and SocioFILE, and which conclusions can be extracted given a set of results. Table 2 shows the correlations between the different marks obtained during the course, and for every

specific part of the final exam (i.e. a part related to the syllabus consisting of 25 questions, and a part related to the assignment consisting of 5 additional questions). According to these findings, the marks in the assignment and the marks in the exam correlate positively. More specifically, it needs to be underscored that assignment marks correlate not only with the specific questions of the exam dealing with CA and DL, but also with questions related to the other content of the syllabus.

Table 2. Pearson correlations between marks in the mid-term exam, in the assignment, in the final exam and in the specific questions (n=176 students)

	<i>M</i>	<i>SD</i>	1	2	3	4	5
1. Mid-term exam (out of 2)	1,2	0,4	—	—	—	—	—
2. Assignment (out of 2)	1,5	0,4	,10	—	—	—	—
3. Final Exam: Total (out of 6)	3,2	0,8	,40***	,21**	—	—	—
4. Final exam (excluding assignment-related questions) (out of 25)	16,7	3,2	,47***	,43***	,93***	—	—
5. Final exam (only assignment-related questions) (out of 5)	1,3	1,1	-,02	,36***	,26***	,34***	—

Note. ** = $p < .01$; *** = $p < .001$

In the final exam, students who did the writing assignment and the oral presentation differed from those who only assisted to the lectures and presentations (see Table 3). Specifically, students who did the writing assignment and the oral presentations obtained better marks both in the questions dealing with CA and DL, and with those dealing with the rest of the content of the syllabus. Therefore, in equal conditions, this method shows to be more effective to foster competences in CA and DL than a mere lecture.

Table 3. Mean differences in exam marks depending on whether the student did the exam or not

Variable	Participants of the experience (n = 200)		Only listening to lectures (n = 47)		U
	M	SD	M	SD	
Final exam (excluding assignment-related questions) (out of 25)	16	4,69	2,85	5,32	516***
Final exam (only assignment-related questions) (out of 5)	1,25	1,02	0,27	0,74	2001***

Note. U = Mann-Whitney's U. ***= p < .001

4. Concluding Remarks

The methodology used in this experience has shown to be successful in combining DL and CA. In particular, the process of answering a socially relevant question, through selecting keywords and analysing scientific articles from different databases, compelled the students for its experiential aspect. This methodology demands the student to make an abstraction of a social issue considering its underlying psychosocial processes, while the teacher supports the autonomy of the student in every part of the process, a key aspect for promoting their self-determination as shown in other educational contexts (Gillet, Vallerand, & Lafrenière, 2012). With regard to the problematic of managing information effectively, the usage of tools such as summary tables and filters like cites of the article and most cited authors facilitate the process of selecting the most appropriate author. In addition, these criteria let the teacher and students account for every step in the decision process. Concerning limitations of this intervention, the high demand of face-to-face supervision suggests the need to standardized more the teaching process creating tutorials for every part of the process. Also, another limitation refers to working in big groups. In his experience groups were big, and next applications of this intervention will make them work in pairs. To end with, one of the most prominent difficulties was the lack of students' experience with this kind of task, which made it quite tedious for the students in the first stages, but this situation justifies and gives value to our methodology and learning objectives. In sum, this methodology has taught them effectively competences in DL and CA, through compelling questions that motived them to learn more, and in doing so, this knowledge has shown to be translated to other contexts as in the final exam. Thus, this constitutes a good learning process that may facilitate the ulterior generalization of the competences in CA and DL. This experience offers important insights on how to educate future professionals that need to act efficiently and rigorously in the Information Society.

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Virtual USATIC: A totally on-line conference to share good practices and experiences using ICT on Higher Education

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Abstract

During the last decades, the use of virtual environments and platforms to leverage the learning-teaching processes has increased enormously. However, there exist few virtual initiatives to discuss and promote good practices on these environments. This paper presents the initiative Virtual USATIC (Ubicuo y Social: Aprendizaje con TIC), a conference with a totally virtual format, whose main goal is to provide a virtual environment where people involved in higher education (students, professors, etc.) can share and discuss their experiences about the use of Information and Communication Technologies in learning processes. Moreover, the conference also promotes the participation of the attendants to on-line tutorials, courses and virtual training workshops on specific topics (Digital Right Managements of material, Accesability and Usability of materials, etc.) where all participants can learn and experience on issues related to the conference. This initiative started on June 2013 and has been repeated every year since then. So, different parameters to evaluate its evolution and success are described along.

Keywords: *Virtual Conferences and Learning Environments; Social Media ELearning; High Education with ICT.*

1. Introduction

During the last decades, new business models and changes in society are arising due to the constant evolution of Information and Communication Technologies (ICT). Thus, for example, traditional post mail has been almost substituted by e-mails. Learning processes and systems should also change in order to be more efficient, take advantage of ICT and be adapted to this new context, usually called Information Society.

With this idea in mind, a group of teachers of the University of Zaragoza decided in 2013 to organize a conference named Virtual USATIC (Ubicuo y Social: Aprendizaje con TIC; Ubiquitous and Social Learning with ICT, <http://www.virtualusatic.org/>). The main purpose of this conference is providing a work environment to promote experiences to improve the quality of teaching by means of sharing information, ideas, knowledge, research results and teaching experiences among the community involved and interested in learning processes supported by ICT, in particular, professionals in the field of higher education whose instructional language was Spanish. In addition, the conference has enabled the training of teachers through the organization of virtual workshops on ICT tools.

Moreover, we decided to beg for a completely virtual event developed in the virtual platform CourseSites to increase the participation and to reduce the costs of attendance. Moreover, the participation in the conference is open access and free, if certification is not desired. So, it allows exchange, while it offers the possibility of training in strategic topics of professional development, as we currently understand learning: ubiquitous and social.

The rest of the paper is organized as follows. In Section 2, some information about the Red EuLES, the organizer, is depicted. The structure of Virtual USATIC is described in detail in Section 3. In Section 4, analytics about the participants in the different editions of the conference are shown. Then, in Section 5, results of the surveys are presented. Finally, in Section 6, conclusions and future work are presented.

2. About Red EuLES

Virtual USATIC is a virtual conference organized by Red EuLES (<http://eules.unizar.es>), an interdisciplinary educational research network in uLearning environments in higher education. The Red EuLES' objectives are the interaction, cooperation and transfer of knowledge and technology and the exchange of experiences and resources among the educational community, in relation to uLearning environments in a higher education level. We understand this model in its extensive and opened meaning, and unifying the different evolutions of the learning process combined with the latest technology trends, ranging from bLearning models (Blended Learning) through eLearning (Electronic Learning), mLearning (Mobile Learning) and Web 2.0, until arising the concept of ubiquity that allows us to take the teaching-learning process at any time, place and situation. At the same time, Red

EuLES contributes to increase the visibility of the participant institutions and thus to collaboratively create and share knowledge to improve teaching quality.

This network, promoted and financed by Cátedra Banco Santander (U. of Zaragoza, Spain), has been recognized as an Interdisciplinary Network of the U. of Zaragoza since 2010.

3. Structure of the Conference

The duration of the conference was 5-days in the first edition and 4-days in the rest of editions celebrated so far. In particular, the conferences lasted from monday to thursday (to friday in the first edition) and each day was dedicated to a particular topic related to Ubiquitous and Social Learning. Concretely, these topics have been: 1) Learning platforms and environments, 2) Materials and Resources, 3) Tools 2.0, and 4) Social networks and uLearning.

The first event each day was a plenary session, moderated by two members of the organization, where a guest speaker gives a keynote; e.g., those of last edition were:

1. How is the digital transformation of universities impacting on educational innovation? M^a del Carmen Romero Ternero, Director of the Digital Strategy Secretariat of the Digital Development and Evaluation Vicerrectorado at the Universidad de Sevilla, Spain.
2. Towards a new school. Toni Solano, Language and Literature teacher and ICT trainer at the Secondary School Bobalar, Castellón de la Plana, Spain.
3. WEB 2.0 tools: from substitution to transformation. Santiago Campión, teacher in the area Didactics and School Organization at the Universidad de La Rioja, Spain.
4. Dissemination of knowledge as a form of learning. Clara Isabel Grima Ruíz, Applied Mathematics Professor at the Universidad de Sevilla, Spain.

After that, participants were available to discuss, in forums, about several works (submissions and posters) previously selected in a revision process. Experts in the subject energized the forums, to leverage the interaction and discussion among participants.

On the same platform, training workshops were developed. They were eminently practical and required an average commitment of 10 hours, which each participant may perform over the duration of the workshops. As an example, the training workshops of last edition were:

1. Build your Educational Website with Google Sites
2. Intellectual Property and Licensing of Contents
3. QR Code: How to Use them in Teaching
4. How to Easily Create Educational Video Tutorials with ScreenCast-o-Matic
5. How to Use YouTube to Post and Manage your Educational Videos
6. Open Educational Resources (OER): what are they? and how to use them?

7. Designing Forms and Online Surveys with Google
8. Forms Answers Management and Administration and Online Surveys with Google

After each edition of the conference, the proceedings have been published in digital format with an ISBN, including every submission and poster presented. This publication is free access for all the speakers and the last ones had an extension of 800 pages. Besides, in 2015 edition, selected papers were invited to write a book chapter. The Cátedra Banco Santander of the U. of Zaragoza, with the publisher Prensas Universitarias de la U. de Zaragoza, published the complete book in a special issue in paper (Allueva Pinilla & Alejandro Marco, 2016).

4. Participation in the Different Editions

In the first edition of the conference celebrated in June 2013, there were 340 people attending, 55 of them presented their works to be discussed in the forums. In the following edition, in June 2014, more than 550 people attended and could debate and discuss the content of more than 160 accepted papers and posters. In June 2015, 708 attendants participated in the conference and 290 of them presented a communication or poster. In the last edition celebrated so far (in June 2016), 498 attendants participated in the conference and 246 of them presented a communication or poster (see Figure 1 and Figure 2).

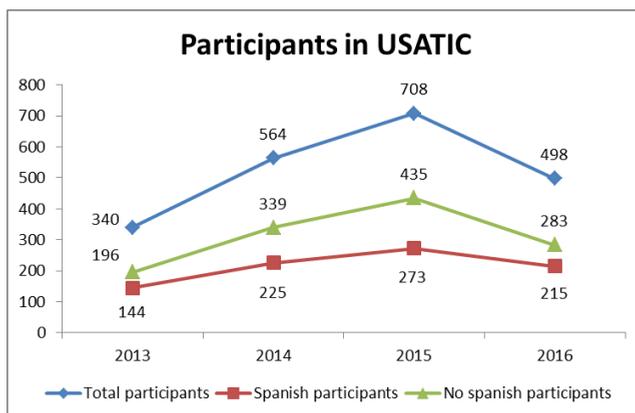


Figure 1. Participants in the different editions of the Virtual USATIC conference. Source: own (2016).

We would like to highlight that there has been a large number of authors who have participated in several editions of the conference, as we think it represents the idea that participants consider that the conference is really interesting. In addition, only around 50% of the authors pay a small fee to receive a certificate.

Finally, Figure 3 shows the number of communications and posters presented in the different editions, and Figure 4, the amount of contributions grouped by topics.

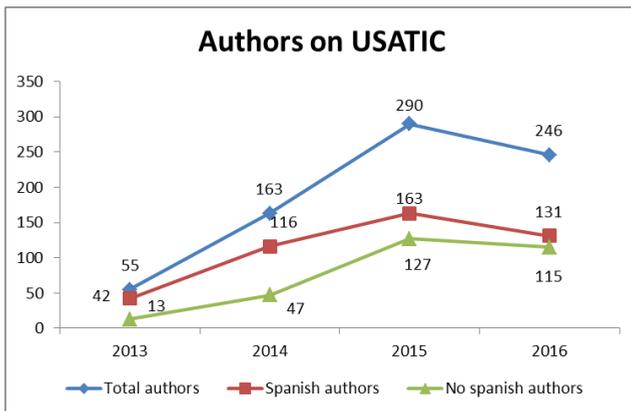


Figure 2. Authors in the different editions of the Virtual USATIC conference. Source: own (2016).

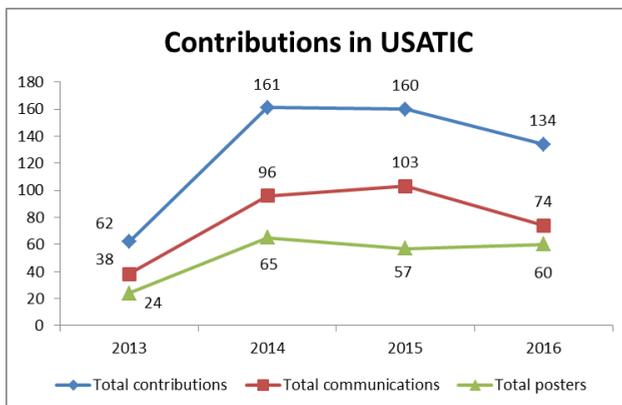


Figure 3. Contributions in the different editions of the Virtual USATIC conference. Source: own (2016).

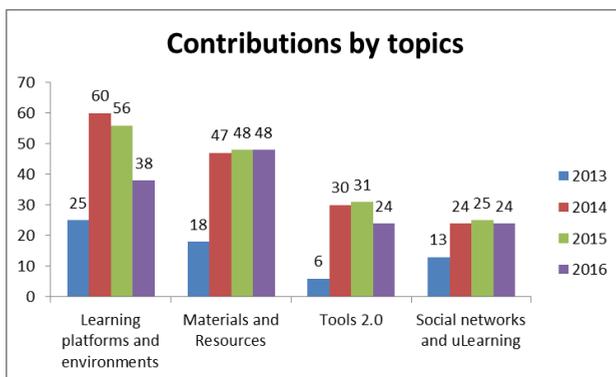


Figure 4. Contributions by topics in the different editions of the Virtual USATIC conference. Source: own (2016).

The number of countries where attendants come from is also representative: in 2013, 17 different countries were represented; in 2014, 24; in 2015, 21; and in 2016, 23. The 32 countries represented so far in the conference were: Argentina, Australia, Bolivia, Brasil, Canada, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, España, Germany, Guatemala, Honduras, Italia, México, Nicaragua, Panamá, Paraguay, Perú, Poland, Portugal, Puerto Rico, The Netherlands, United Kingdom, República Dominicana, Sweden, Switzerland, United States, Uruguay and Venezuela.

5. Participants' Satisfaction Survey

Participants were asked to fill in a final satisfaction survey, and 390 of them did it. Results provided were similar in all performances. Here we present results on the key issues of the last edition. We also focus on results provided by those participants attending the last two editions (both) and we will name them as “repeat participants”.

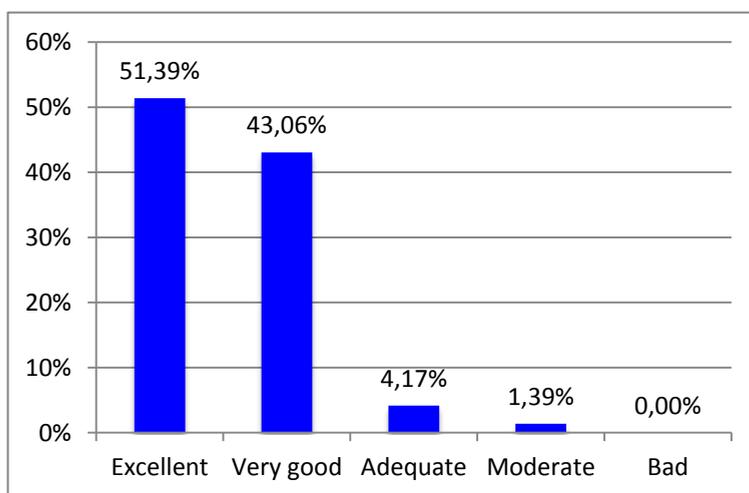


Figure 5. Overall assessment of the Virtual USATIC conference. Source: own (2016).

Figure 5 shows that the overall assessment of 94,45% of participants answer is excellent or very good. The percentage increases to 96% in repeat participants.

In Figure 6, results on review issues related to the content of the conference are presented. Participants were asked about: quality of the information contents, structuring information, content fragmentation, information volume and relevance of conference topics. Results are also mainly excellent or very good. Besides, the answer to the question: Was the conference useful (very much - less - nothing)?, 92% answered very much and no one nothing. In addition, nearly 100% of repeat participants answered very much to this question. Moreover, the degree of satisfaction with respect to the degree of learning of all participants is 100% very satisfied or fairly satisfied, around 50% each one of these options.

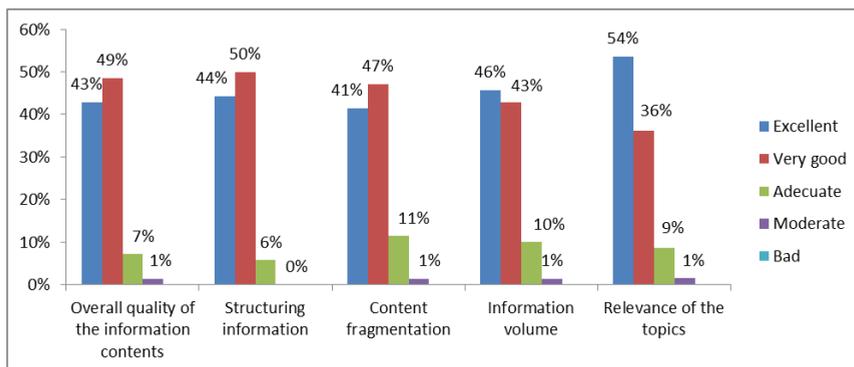


Figure 6. Review issues related to the content of the Virtual USATIC conference. Source: own (2016).

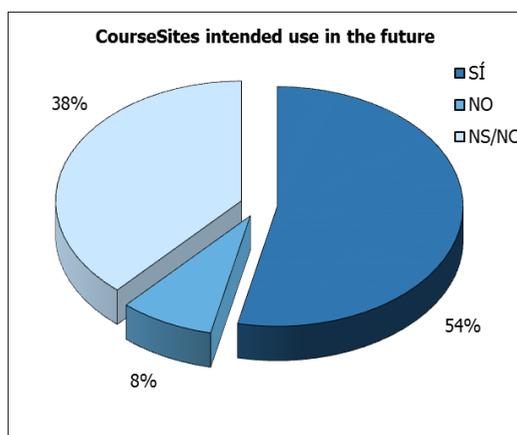


Figure 7. Intended use in the future of the CourseSites platform. Source: own (2016).

In relation to the eLearning platform used, CourseSites, there was an overall satisfaction and 54% of participants said that they intended to use it again and only 8% of participants said that they would not use it in the future (Figure 7).

When participants were asked about how likely were them to recommend Virtual USATIC to a colleague or a friend, practically all of them (98%) answered *YES, I recommend the conference*. Finally, practically all of them (99%) said *YES I would like to participate in a new edition of Virtual USATIC conference*. Regarding the results obtained on the satisfaction of participating in training workshops, a brief set of results on assessment of the overall quality of workshops and assessment of quality of contents (rated from 1 to 10), is presented (Figure 8). Results express the high degree of satisfaction with the training received in workshops (described in Section 3). The score was excellent (9 or 10 points) in more than 70% of cases and there was no score lower than 6.

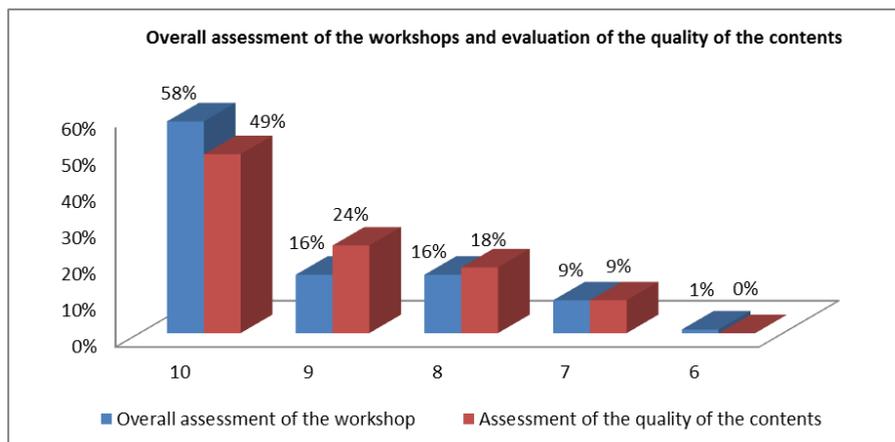


Figure 8. Overall assessment of workshops and evaluation of the quality of contents. Source: own (2016).

A final consideration that may be relevant in the analysis (apart from those relating to satisfaction) is how respondents said that they obtained information on the conference for the first time (can be several): by email (50%), informed by their institution (22%), a colleague or friend informed them (37%), through social networks and website (10%).

6. Conclusions and future work

Results obtained so far are good. Many people already know and have participated in the conference. Also, many countries were represented (32 in total). Moreover, the participants that filled the surveys are satisfied. Thus, in the last edition, 94,45% of participants answered that the overall assessment of the conference was excellent or very good, and 92% answered that the conference was very useful. Moreover, almost all of them (98%) said that they were going to recommend Virtual USATIC and that they would like to participate in a new edition (99%). Satisfaction with the training received at the workshops has also been very high. So, we plan to continue organizing this conference next years.

Main goals for next years are consolidating this community exchange, number of participants and submissions, as well as increasing workshop educational opportunities.

Aknowledgements

We would like to thank all institutions and companies supporting Virtual USATIC.

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Evaluating Learner Engagement in Arts Education: Perspectives from Music and Drama in Education

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Abstract

In this paper we aim to investigate learner engagement and how it can be evaluated, in the context of higher education research. Specifically we consider learner engagement evaluation in Arts Education, where the educational focus is on the process, rather than the product – drawing on music and drama in education research and practice. First, we position the notion of evaluation as opposed to assessment, with attention to its etymological roots. Second, we discuss the multifaceted notion of engagement as process, exploring the nature of learner engagement and a number of possible engagement indicators. We then synthesize these categories into descriptors which, we argue, can be useful to evaluate learners' engagement in arts education practices. Third, we ground theory into practice by offering two examples drawn from the authors' PhD case study research, respectively in music education and drama in education. We conclude that engagement is a multifaceted construct, which we frame as a mutual exercise of agency – whereby the teacher and the students act in a partnership as co-artists.

Keywords: *engagement; evaluation; arts education; process drama; drama in education; process music; music education.*

1. Introduction

In this paper we set out to investigate the nature of learner engagement and how engagement can be evaluated in the context of higher education research. The discussion on engagement and its evaluation is situated within the context of Arts Education, more specifically within music and drama in education, where the educational focus is on the process, rather than the product. In drama-based pedagogy, also known as process drama (O'Toole, 1992), the focus is on meaning-making to experience a collective 'dramatic elsewhere' (a process), rather than rehearsing and performing for an audience (a product). Similarly, in process music the focus is on practicing and listening to explore meaning transactions and possibilities (process) rather than music reading and performing skills to create recital events (product). In these contexts, as well as other arts-based practices, where the nature of the artistic form summons a process-based pedagogy, the need to evaluate engagement as/within the process clashes with the psychometric requirements of the academic assessment system. This paradox opens up a number of questions, paved by key educational theorists like Dewey (1934), and more recently Kress (2009) and Fautley (2010), related to the effectiveness of contemporary assessment. In the field of Arts Education, key scholars have long pondered on such matters, reflecting on the importance of framing the arts in education in terms of evaluation, rather than assessment (Abbs, 1989; Eisner 1985).

Before proceeding any further, it is important to define the terminology that will be used throughout the paper, particularly the difference between 'evaluation' and 'assessment'. On an etymological level, the term 'evaluation' comes from the French noun *évaluation*, with the verb *évaluer* meaning 'to find the value of'. 'Assessment', on the other hand, comes from the Latin *assessus*, sitting-by, past participle of *assidere*, 'to sit beside'. In its Medieval Latin origin, 'assessment', from *assessare* was related to tax collection, whereby a judge's assistant would 'sit beside' a person to estimate the amount of a fine or a tax. Evidently, the terms 'evaluation' and 'assessment' have very different roots, and have been taken up by contemporary society to mean different things, respectively looking at the 'how' (process) and the 'what' (product) in students' engagement. In this paper we subscribe to a 'process' vision of evaluation, within the construct of learner engagement, as illustrated below.

2. Defining Learner Engagement in Arts Education

2.1. Engagement as Process

Learner engagement is an elusive concept, which cannot be easily pinned down. Any experienced educator would agree that it is somehow connected to learner motivation, emotion and autonomy; yet when it comes to capturing the elements that inform this notion, these parameters become less tangible. In the last three decades, several key educational theorists have attempted to define it. As Svalberg (2009) argues, “researchers and practitioners alike are currently trying to come to grips with ‘engagement’ as the place where learning happens” (p. 243). Interestingly, in Kress’ (2009) definition of learning, ‘engagement’ is encompassed within the learning process. In fact, he defines ‘learning’ as “the result of a semiotic/conceptual/meaning-making engagement with an aspect of the world” (p.19). Kress (2009) subsequently defines ‘engagement’ as: “The meaning-maker’s ‘interested’, energetic and sustained involvement with a framed segment of the world, which is at issue in an interaction” (p.38).

Within this general definition of engagement, our research focuses on a particular aspect of learner engagement within the arts, and that is, engagement with language – where language is intended in its verbal and non-verbal domains. To this respect, while Author’s (2014) research deals with understanding the acquisition of a second language by using drama in education, and the nature of learner engagement resulting from such intervention, Author’s (2014) research involves looking at engagement as intrinsic/extrinsic motivation in music education. The problem with attempting to define learner engagement is that it can afford a dual, at times contradictory interpretation, both as a process and as a product. Svalberg (2009) acknowledges this issue by offering a definition of engagement with language that encompasses both:

“Engagement is a cognitive, and/or affective, and/or social state and a process in which the learner is the agent and the language is the object and may be the vehicle (means of communication)”. (p.244)

Svalberg’s (2009) definition positions engagement as a process and a state, across three axis: cognitive, and/or affective, and/or social. In our vision, in line with a Deweyan philosophy of education (Dewey, 1934), “and/or” in the definition above can be safely replaced with ‘simultaneously’ – that is, engagement within the arts in education is simultaneously cognitive, affective and social. Moreover, we argue that another fundamental dimension of learner engagement is aesthetic engagement, indented as learners perceiving through the senses, internalizing and re-elaborating form through symbolic and metaphoric means, to express their own meaning (Abbs, 1989; Vygotsky, 2004).

2.2. Learner Engagement as Agency

Van Lier (2008) advocates ‘agency’ as key to the engagement and learning process. If seen as a perceptual process of attention, engagement with learning requires an ‘active perception’ or “perception-in-action”, a phrase coined by Van Lier (2004, p. 97) drawing on Vygotsky and Luria (1994), who define learning as a “newly born unity of perception, speech and action” (p. 109). Van Lier (2008) frames agency as “something that learners *do*, rather than something learners *possess*; in other words, it is behaviour, rather than a property (p. 171). Van Lier identifies three qualities of agency:

1. Agency involves initiative or self-regulation by the learner (or group);
2. Agency is interdependent, that is, it mediates and is mediated by the sociocultural context;
3. Agency includes an awareness of the responsibility for one’s own actions vis-à-vis the environment, including affected others. (2008, p. 172)

We endorse Van Lier’s definition and extend it further, with attention to the relationship between the students and the teacher. In Van Lier’s third point, we argue, ‘affected others’ does not only refer to other students, but can also refer to the teacher. As a matter of fact, in process drama and process music agency significantly affects, and is affected by, the pedagogical relationship between the students and the teacher. Here we draw on Sen’s (1984) discourse of agency as freedom and well-being, what the “person is free to do and achieve in pursuit of whatever goals or values he or she regards as important” (p. 203), and proceed to frame agency in terms of the active exchange of students’ and teachers’ ideas, resulting in a ‘flourishing’ (Snow, 2015) and an ongoing challenge to opinions, attitudes and, ultimately, identity.

2.3. Indicators of Learner Engagement as Agency

What indicators can be used to evaluate such engagement process? In our research, described in the section below, we identify a number of indicators, manifested as a change in the meaning-makers’ cognitive, emotional, social and imaginative perception-in-action, occurring within verbal and non-verbal planes. These indicators have been synthesized into three descriptors: 1) Agency as autonomy, intended as: a sense of ownership of the work; a willingness to create; willingness to self-assess; 2) Agency as risk-taking, manifested as: willingness to share one’s creations; making discoveries; making choices; opening up one’s vulnerabilities to the group and to the teacher; making an emotional investment in the work; 3) Agency as playfulness, intended as: willingness to question reality, including self, others, the teacher and the curriculum; exploring different meanings; injecting irony through symbols and metaphors. In other words, we define the student-teacher agentic relationship as a meaning transaction requiring a degrees of autonomy, risk-taking and playfulness towards the self, others, the teacher and the curriculum.

3. Case Studies

In the section below we offer two examples to ground theory into practice, drawing on our research in music and drama in education. Within the scope of this paper, we limit ourselves to giving an overall portrait of the research design, and including one significant anecdote that can illuminate an aspect of the discussion.

3.1. Case Study One: Music Education

This case study is part of a wider doctoral study on music education, undertaken at Ca' Foscari University (Italy). The data collection, grounded in a mixed methods paradigm, took place in 2014, in two music-oriented Middle Schools in Rome (experimental and a control group). The research design involved designing and facilitating an 18-week long process music intervention with the experimental group (seven 10 year-old students). Research methods included: filming the process music and control group lessons, interviewing the control group's music teacher, and administering four pre- and post-intervention tests: Advanced Measures of Music Auditions (AMMA) Edwin E. Gordon; Torrance Test of Creative Thinking (TTCT Figural); Thinking Creatively with Sounds and Words (Level 1 TCSW Torrance, Katena-Cunningrom); Cornell Critical Thinking (CCTT Level x). The data analysis was conducted using MAXQDA video analysis software, cross referencing the video recording and transcription data with the researcher journal, control teacher's interview, pre-and post tests, students' self-evaluation and music compositions.

For the purpose of this paper, the discussion zooms on one 10 year-old student, Giorgio, and his evolution throughout the intervention. This analysis is focused on a series of 11 one-to-one guitar lessons (40 minutes each) between Giorgio and the teacher-researcher. Before the intervention, Giorgio had studied guitar for three months in a traditional, transmissive way based on reading and practicing. He had basic technical skills (First position, beginner right hand technique and music reading) and in the first meeting he appeared uninterested about doing music classes again. He also seemed inclined to find shortcuts to gain the maximum results for minimum effort. But even so in his first class, upon composing his first piece, he started to develop a sense of ownership to the work, making choices about his music writing: *No*. [He observes carefully his composition for about two minutes] *C is not right here!* Or: [To the teacher-researcher playing out his composition] *Could you play from here? I want to hear my piece clearly*. His personal mind-set to music making emerged in the third lesson: *There is something I want to do. I'd like to compose a piece for that* [showing a piece of paper] *During our Italian class we read some poetry and I want to write something based on that*. His risk-taking and emotional investment to music making became clear in the fifth lesson. He wrote a piece because he, confessed, was infatuated with a girl, and asked: *Could you come with me tomorrow? I want to play this piece and I'll need some help to play perfectly on time*. At this point his

composition was becoming more personal. He started to come up with his own technical solutions when he did not know how to write something, inventing his own music writing. He also started to correct the teacher-researcher, in terms of errors in transcribing his composition on the computer, as well as how his compositions were played. Over the course of the 11 lessons, something changed in the way he listened other pieces of music. One time, the teacher-researcher asked him to listen to the 4th movement, ‘Allegro Pizzicato’ from the Bartok’s String Quartet No.4 in C major, to show Giorgio certain similarities with his composition. After listening, he stated: *They play wrong here* [Points to one section of the score] *This was meant to be played piano (p)* [he plays on his guitar]. *It’s a piano-pianissimo (ppp). In my next composition I also want to use ppp.* Four classes before the end of the intervention, the other students decided to attend a music competition to play their compositions in front of an audience. At this possibility Giorgio said: *I’m not coming. What for? How many other schools will be there?* Yet, after two weeks, he completely changed his mind and decided not only to participate in the competition, but also to conduct his own piece, which he had written for a guitar ensemble.

From this brief account of the data collection, learner engagement in the process manifested as autonomy (ownership of the work; willingness to create) risk-taking (sharing creations; making choices; emotional investment) and playfulness (willingness to question reality; exploring different meanings), with the teacher playing a key role in this mutual exchange.

3.2. Case Study Two: Drama in Education

The case study below is part of a wider doctoral study on drama in education, undertaken at Griffith University (QLD, Australia). The aim of the research was to explore the constructs of learner engagement and teacher artistry, when using process drama to teach Italian as a Second Language (L2). The data collection took place in three L2 schools (one University and two private schools) of adult international students in Milan, Italy. The research design saw the teacher-researcher create and facilitate 45-hours of process drama, spread across three case studies, with 60 participants: 46 international students, who took part in the drama workshops, and 16 teachers, who observed the workshops to take notes on learners’ engagement. Data collection methods included: filming the process drama lessons; interviewing the student-participants; interviewing the teacher-participants (before and after the observations); analyzing teacher-participants’ observation notes; administering a self-evaluation engagement questionnaire to the student-participants after each drama workshop; conducting a final focus group with all participants, using Video-Stimulated Recall (VSR) and other embodied approaches such as using props and image theatre to trigger reflection on their engagement. The data analysis was informed by a microgenetic approach and conducted using NVIVO 10 analysis software.

For the purpose of this paper, the discussion briefly focuses on one 27 year-old Russian student, Yelena, who seemed to have connected with an idea beyond the drama, related to 'time being an illusion'. At the end of her fourth workshop, she approached the teacher-researcher privately, visibly thrilled, whispering she just had an insight. Yelena disclosed a strong connection related to a discussion on the relativity of time and space. This insight affected her profoundly during her involvement with the drama. In the focus group, Yelena pointed out how her identification with the drama was so strong that, after the drama, for two days, she was deeply engaged with the drama: *I was still inside the situation, with my head, with my thoughts, with my senses*. Yelena's self-evaluation score for her engagement in workshop 4 was 10/10; she also wrote some additional notes in her questionnaire: "Emotional; I had goose bumps at the end of the class". Interestingly, during that specific workshop, her intense connection created an internal conflict with the group. In fact, as they were improvising, in role, using a strategy they had previously agreed upon, Yelena changed tactic of her own accord, causing confusion and frustration in the others. When prompted to comment, Yelena replied: *When [the main character in the drama] came in... nobody made a suggestion, so... I took the initiative in my hands and I changed topic and nobody really understood this*. After the improvisation, this incident created a heated discussion in the group, who openly confronted her about it. This instance was framed by Linda, a teacher-participant, as "evidence of high engagement" (p.9:22-23), in terms of the group emotionally investing in the dramatic situation. Thus, paradoxically, Yelena's strong connection with the work triggered a sense of autonomy that initially disconnected her from the group. Eventually Yelena apologized to her classmates and the group bonded even more. The teacher-researcher channeled this episode, and the reflection that followed, to heighten the dramatic engagement in the drama. This incident, and the discussion that followed, heightened Yelena's awareness of her own attitude during team work: *I learnt that the group can be like a person, like for example the sun and its rays [mimes the rays] – this is a group, but all come in the centre*. Yelena's experience suggests that by exercising agency as autonomy, willingness to become vulnerable and emotional investment in the group, she became fully engaged, deepening her understanding of herself. Yelena's engagement here, manifesting as agency, combined with meta-reflection, resulted in a shift of opinions, attitudes, in a kind of 'flourishing' (Snow, 2015) that may have impacted on her sense of identity. By looking at both case studies, it is obvious that the meaning-makers' engagement manifested as simultaneously cognitive, affective, social and aesthetic.

4. Conclusion

Autonomy, risk taking and playfulness. Three descriptors that may help arts education researchers to evaluate engagement. The question is: for what kind of education? We have argued that engagement is closely related with the notion of agency. We suggest that placing agency at the centre of the curriculum also means to highlight the students' uniqueness, subjectivity and talents. Accordingly, we wish to consider the possibility of extending this further to reframe Arts Education following a new "humanistic approach" (UNESCO, 2016). Future research could focus on teacher education and pedagogical practices and policies, with agency at the heart of a teacher-student relationship, in a mutual partnership as co-artists. In other words, shifting paradigms from engagement as aesthetic judgement, to engagement as co-creation of meaning.

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Environmental training at companies. The case of Volkswagen Navarra

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Abstract

Companies have made great strides in strengthening their environmental maturity and sustainable production. Nevertheless, many of them have not transmitted their knowledge to their workers, and this makes it more difficult to have employees participate in their company's sustainability improvement process. In the particular case of Volkswagen Navarra, they have a lot of experience in environmental management, but they don't have a proper program for teaching their workers so they can be more involved in the environmental aspects of the company. This paper proposes an environmental training program that can be used either as an e-learning course or a face-to-face course with the objective of providing employees with the knowledge and skills necessary to participate in the improvement of environmental aspects.

Keywords: *environmental management, training, course, company*

1. Introduction

The intensive use of natural resources to produce goods and services has led to a large increase in the generation of waste. It has been estimated that “we are more than ten times better at wasting resources than at using them” (Von Weizsäcker et al., 1998). Fortunately, society is becoming increasingly concerned about the environment. Similarly, customers are becoming more aware of resource depletion and companies’ desire to continuously improve environmental management and measures (Claver et al., 2007).

Moreover, since the publication of “Our Common Future” and “The Brundtland Report” governments and institutions have encouraged the development of less polluting processes and products (Brundtland Commission, 1987), and current policy makers are oriented toward boosting circular business models that are in line with nature. One such example is the European Commission’s (2015) action plan for the Circular Economy. Specifically, since the beginning of the new millennium, companies have greatly strengthened their environmental management by accepting the responsibility that each entity has and its transcendental role in society (Labuschagne et al., 2005). Governments and companies are becoming more aware of the necessity of not only creating eco-friendly products but also improving their production processes in an environmentally friendly way. There are many international environmental standards that might be useful for companies that are willing to improve. These standards provide specifications and guidelines for environmental management systems, environmental audits, eco-design, eco-labeling, life cycle assessment, environmental behavior evaluation and environmental communication (Aenor, 2008).

In order to improve the quality and ecological performance in a sustainable way, it is important that companies to implement a continuous improvement system in which a series of factors need to be developed: information and communication systems, the creation of a culture of improvement, appropriate training, commitment and participation of the workers, management and monitoring of the improvement system (Bateman and Rich, 2003), among others.

Jurburg et al. (2016) posit that “the best way of training [employees] to participate in the continuous improvement system is learning by doing, and therefore, everybody should be involved in the learning process”. Some models that explain the sustainability of continuous improvement as an evolutionary process of skills acquisition define as excellent those companies that follow the concept of “learning organization” (Bessant et al., 2001). However, according to a recent study done on companies considered to be excellent in management, many of the necessary habits are not yet fully ingrained; for example, it was found that there is a general lack of documentation on past activities (Jurburg et al., 2015).

Therefore, the main objective of this study is to create a training package that will allow companies to train their employees with the purpose of making employees aware of the

importance of evaluating and monitoring the environmental impact of their work while at the same time informing them of the environmental actions that the company is carrying out to achieve environmental goals. As a consequence of this training, the workers will be more aware of the importance of environmental management and they will be more prepared to get involved in the company's continuous improvement activities that are aligned with its environmental objectives. In this way, a culture of environmental management is created.

2. Method. The Case of Volkswagen Navarra

This study was carried out at Volkswagen Navarra, S.A., one of the 119 factories that the Volkswagen Group has all over the world. Located in Pamplona (Navarra), this factory has been producing the Polo for the whole world without interruption since 1984.

Volkswagen Navarra has been actively interested in the environment since the end of 1995, when they began to develop their Environmental Management System, which eventually led to the creation of the Environmental Department at the end of 1996. It should be noted that in 1997, Volkswagen Navarra became the first company in the automotive sector at the European level to obtain ISO 14001 certification and the first automotive factory in Spain to earn EMAS certification. Since then, Volkswagen Navarra has been very aware of environmental aspects all throughout its manufacturing process, focusing on improving waste management and energy efficiency and reducing the environmental impact of its processes. In addition, in November 2010, Volkswagen Navarra became the first company in the automotive industry to obtain ISO 16001 certification for its Energy Management System. Despite of the recent prestige controversy related to environmental issues in the automotive sector, this factory history proves the high degree of Volkswagen Navarra's involvement in environmental management and the company's environmental knowledge. In this sense, the employees engagement is quite important because theory and practice indicate that "all employees are environmental managers" (Cohen-Rosenthal, 2000).

Given the above, we believe that more value would be created in the company if all employees were aware of the ecological improvement projects that have been carried out and the environmental knowledge that has been generated by their company since the 1990s.

The main objective of this project is to create a training package so anyone in the Volkswagen Navarra's plant can understand the importance of environmental management and how they can contribute to its improvement from their own positions of responsibility. This training package has been created with the collaboration of the Sustainable

Improvement team at the University of Navarra, as they understand the environmental challenges that companies face and they are experts in training.

2.1. Training package design

The training package has been designed according to the following propositions:

- Raise awareness about environmental aspects. For this purpose, a static part containing novel content about the environment was developed in order to provide an overview of the subject. Therefore, the main idea of the static part is that it is not an updatable section; if modification have to be made, the vast majority of information is kept in its original form. All the data that is used in this section is related to daily activities so participants can have a better understanding of the magnitude of the environmental problem taught.
- Show the environmental actions that are carried out at the plant and their results. This part is dynamic as the content can be updated according to the new actions that are developed. Workers can gain a better understanding of what kind of improvements they can carry out in their own work and what results they can obtain.
- Assess knowledge acquired. It is important to verify that the information is correctly assimilated by trainees. To that end, several questionnaires were developed so participants can demonstrate the degree to which they have understood the course by taking a self-examination test.

The training package should be organized and presented in a visual way so it is attractive to the workers taking the course. It was decided that a series of training modules would be developed based on the five "Think Blue" indicators plus an introductory module. The concept of "Think Blue" represents the long-term philosophy of the Volkswagen brand for achieving environmental sustainability based on the three fundamental pillars: ecological solutions and products, individual behavior, and environmental initiatives. Volkswagen uses the color blue to represent resources that are worthy of protection, such as water and air. Moreover, as blue is the traditional color of the Volkswagen brand, the "Think Blue" concept closely ties the brand with the environmental concepts it encompasses.

In terms of objectives, Volkswagen has set itself the goal of becoming the eco-friendliest and most economical automobile manufacturer for the year 2018. Similarly, Volkswagen Navarra has adopted the "Think Blue. Factory." strategy. The goal is to reduce by the year 2018 and for each vehicle manufactured the following indicators by 25%: water consumption, energy consumption, non-recoverable waste, CO₂ emissions and the emission of solvents.

These five indicators plus the introduction compose the structure of the training package. For each of these modules a static part, a dynamic part and a self-examination test have been developed (Figure 1). It was decided that the information would be provided in the form of PowerPoint presentations and illustrative videos in order to speed up, facilitate and increase the visibility of the modules, in order to promote awareness and involvement by employees.

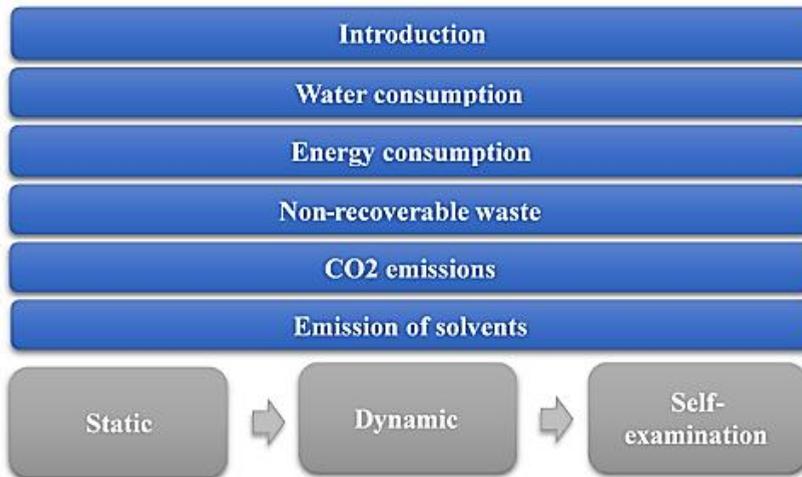


Figure 1. Training package structure

2.2. Information Collection

The qualitative interview is the most common and one of the most important gathering tools in qualitative research (Myers and Newman, 2007). For this reason interviews were held with the environmental managers at Volkswagen Navarra with the purpose of specifying and understanding the different environmental milestones the company has reached, as well as those that the company is planning on reaching in the near future. This task was reinforced by collecting the information that is available on the Volkswagen intranet. Interviews with people who have played an important role in the implementation of different environmental measures or actions were carried out in the same way. This task was complemented by collecting information that is available on both the Volkswagen Navarra intranet and the Group's "Management Web". In addition, external sources and sources from the literature were used to better explain the measures that have been implemented.

3. Results

In starting the training course, it was decided that training material would be used for a face-to-face course with all the workers at Volkswagen Navarra. It was decided that a face-to-face course would assure that all the current employees would take the course, as the company gave the participants release time so they could take it.



Figure 2. Employees attending the face-to-face course

This preliminary format allowed us to include some practice exercises so the workers could better understand some of the concepts (Figure 2). For example, in the energy consumption module, there is a practice activity that uses three different bulbs: an incandescent lamp, low consumption bulb and a LED light. Participants need to use a hand-crank to turn on each of the lights. The effort needed to turn on the incandescent lamp is much greater than the other two. Obviously, the easiest one to turn on is the LED light. This practical exercise makes participants more aware of the energy consumed by each of these types of lights and the importance of managing energy consumption.

A total of 48 face-to-face courses with a total of 343 employees have been run at Volkswagen Navarra, with an average of 7.15 participants per course. After each course, participants were asked to report on their satisfaction level via a questionnaire that allowed them to respond on a 4-point scale (Table 1).

Table 1. Satisfaction questionnaire results

Item assessed	Average
The course was well organized	3.7
The number of students in the group was appropriate for the course	3.8
The content of the course has responded to my training needs	3.4
It has allowed me to acquire new skills / abilities that I can apply to the job	2.8
It has improved my chances of changing jobs within the company or outside it	2.5
I have gained knowledge that allows me to progress in my professional career	2.3
It has favored my personal development	2.9
Degree of overall satisfaction with the course	3.6

As can be seen, all the questions were valued above 2, and the general questions regarding the course organization, the course content and overall participant satisfaction were valued close to 4, meaning that participants were in near total agreement with the questions.

4. Conclusion

The environment is a fundamental variable in the development of companies. As noted above, many companies are stuck in the process of systematizing their environmental management and do not take full advantage of environmental management within the company by not giving all the environmental information they have to their workers.

This project attempted to solve this problem by providing a specific company, Volkswagen Navarra, with materials that can be used to make employees aware of its environmental responsibility in an orderly and structured way. This project made is possible for the company to disseminate the environmental knowledge it has acquired throughout its environmental history to the company environment as a whole. Moreover, having the Sustainable Improvement group from the University of Navarra participate in the development of the training package has allowed them to include their environmental management knowledge, in addition to adapting the training modules so they would meet the company's objectives.

The result of the training courses is that all of the workers can move in the direction proposed by the company's Environmental Department, which will make it will be easier for the company to achieve its environmental objectives effectively and efficiently.

Moreover, in terms of university education, this collaboration with Volkswagen Navarra has provided us with more real examples to use in class, thereby enriching the classes and giving students a look into company life.

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Public Higher Education Governing Boards Composition and Regional Difference in U.S.

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Abstract

Using *The Public Higher Education Boards Database* designed by Association of Governing Boards of Universities and Colleges (AGB) in 2008, this paper reviewed prior studies of governing boards and investigated regional differences in boards' characteristics including board type, selection method, board composition, provision condition, term length, supervision and meeting frequency. The results show that: (1) highly centralized state university governance with more political control exist in West and Middle West; (2) governing boards in Northeast are more autonomous with high percentage of alumni and self-perpetuating members, and less political affiliations; (3) more faculty participation appear in South and West and most Middle West boards do not have removal process and longer length of term.

Keywords: *public, governing board, regional difference*

1. Introduction

Neither the complete autonomy of universities from the state government nor sheer accountability of the institutions to the state does not exist in the U.S. higher education sector. The dual demands of obtaining autonomy and meeting requirements of accountability cause tension when the state and the university regulate affairs occurring in the sector. During the twentieth century, the prevailing pattern of the American campus-state relationship was the increasing intervention by state governments (McLendon, 2003). The fundamental shift of decision-making authority in the 1950s and the 1960s was accelerated by “the continued consolidation of campus governance and increasingly powerful statewide coordinating boards” (McLendon, 2003, p.69) This centralized campus governance is implemented by the consolidated governing boards, which represent the most powerful form of campus governance.

Governing boards have important responsibilities in following five domains: ensuring outstanding leadership, articulating the institution’s mission, maintaining financial solvency, external relations, and self-assessment (Hendrickson & Lane, 2013). Recently Association of Governing Boards of Universities and Colleges (AGB) claimed that governing boards are not translating public concerns about higher education into action in the boardroom and the current gap between the society and higher education’s governing board members is getting greater (AGB, 2012). This failure of governing board’s governance, in fact, originated in its nature—members of governing boards sometimes do not hold expertise which is required to execute legal responsibility over an organization and they do not apprehend campus power structure and do not involve in management decisions, which are essential (Hendrickson & Lane, 2013). Some great efforts, which have been conducted to investigate the organization of boards and the behavior of trustees, include the selection of trustees, board compositions, trustee cooperation, committee structure, relationship with president, and the effectiveness of boards (AGB, 2009, 2010, 2012; Calhoun & Kamerchen, 2010; Knott & Payne, 2001; Minor, 2008; Nason, 1982). However, many of these efforts did not reflect regional differences thoroughly, thereby losing the important ground of college governance study. As institutions in the same region have shared same historical context, demographic changes, resources, and political impacts, governing board’s operating system can have some distinctive characteristics based on their region. This paper will describe the characteristics of governing board based on recent data, and further contribute to current research by detecting a regional difference of boards characteristics as an exploratory way.

2. Literature review

A considerable body of studies have described the mechanism of governing boards and recommended what an effective board should be since the 1970s. AGB governing board survey revealed, in 2010, the average number of the voting board is about 11 or 12. Male trustees outnumbered two times than women. 23.1 percent of board members were underrepresented racial and ethnic minorities (4.1 of percent Hispanics and Latinos, 15.8

percent of African Americans or Blacks, 0.7 percent of American Indians and Alaskan Natives, 2.1 percent of Asians and Pacific Islanders, and 0.4 percent of other races) while 74.3 percents were White non-Hispanic, and 2.6 percents were unknown races. Most trustees (69 %)’s ages were around 50-69 years old. Half (49.4%) of board members of public institutions was business, including 24.1 percents of professional service (such as an accountant, attorney/law) and 15.5 percents of education (AGB, 2010). Compared with the survey also conducted by AGB in 1976, female (15% in 1976) and minority (14% in 1976) members increased a lot (cited in Nason, 1982). Nevertheless, the current composition of governing board hasn’t overthrown the prevalent criticism that people who are white, Anglo-Saxon, Protestant, male, over age 50, coming from business dominate the governing boards (Nason, 1982). The Recent development of studies on governing board is concerned with the structure of governing boards. Several states reformed their higher education governance structure by building a statewide governing board. Although few studies directly investigated how the governing board’s behaviors affect institutional performance, an increasing number of empirical studies tested the impact of higher education governance structure on college tuition, state appropriation, and institutional resource allocation. Knott & Payne (2001) found that universities with a statewide board and with members that are not primarily appointed by the governor had higher productivity and resources. Lowry (2001) demonstrated that public universities in states with statewide coordinating boards or few governing boards, and universities governed by trustees selected by state officials charge much lower tuitions than universities in states of decentralized structures, or governed by trustees chosen by the academic constituents. Calhoun & Kamerschen (2010) took a further step of tuition analysis. Instead of absolute tuition level, they focused on price discrimination, showing that the ratio of out-of-state to in-state tuition was highest among those universities with the most centralized governance structures.

Given this influential role of governing board’s composition and structure, the present study explores differences of the public governing board by region (West, Middle West, Northeast, and South) so that we can offer comprehensive outlook and concrete explanation on the regional difference in U.S. college’s public governing board system.

3. Data

In this study, we used The Public Higher Education Boards Database designed by AGB in 2008. The database currently contains information on each public higher education coordinating boards and governing boards in all U.S. states. The database is a comprehensive and up-to-date source on the composition, structure, and appointment methods of public governing boards. The only 4-year public governing board were included in the analysis because the database only has a limited number of two- year institutional governing boards. Also, we categorize four regions (West, Middle West, Northeast, and South) based on the Census Bureau Regions and Divisions with State FIPS Codes. The organization of the analysis is as follows. Firstly, we described the state governance

structure of public 4-year colleges and universities to get a big picture of different types of governing boards. Secondly, we examined the national trend and regional difference of the trustees' selection methods. Lastly, we compared compositions and trustee restrictions of governing boards in different regions. To analyze differences among regions, we conducted Analysis of Variance (ANOVA) for mean comparison of different regions. When a significant difference exists, we additionally explore the differences among means by conducting post hoc test which provides specific information on which regions means are significantly different from each other.

4. Results and Discussion

4.1. Governing Board Type and State Governance Structure

To describe the state governance structure of public four-year colleges and universities, we categorized states into six categories according to the degree of centralization: comprehensive state governing system (18%), statewide university governing system (14%), university governing system without statewide governing boards (18%), institutional governing boards only (23%), and the combination of university governing system and institutional governing boards (14%). West and Midwest have the most centralized governance as eight of all the nine comprehensive state governance systems are implemented in there, such as Utah, Kansas, and North Dakota.

4.2. Governing Board Selection Methods

Compared with West and Middle West, public governing boards in Northeast and South averagely have a larger size and fewer members appointed by the governor. Governing boards in South have more members appointed or elected by the legislature than other three regions. West and Middle West governing boards are characterized as 5% general public election despite Northeast and South barely have a general public election. Northeast have the highest percentage of alumni association appointed members and self-perpetuating members. (See Appendix. Table 1)

4.3. Governing Board Composition

As Table 2 shows (See Appendix), 70% of public governing boards have student board members and only 16% having faculty members. 4% of presidents are also the voting members of governing board and 10% presidents are non-voting members. 12% of governing boards have the governors as ex officio voting members, and only 2% are nonvoting members. Comparing different regions, we found that over 80% of governing boards in West and Northeast have student members while only 56%-67% of governing boards in South and Middle West have student members. South has a much high percentage of governing boards with faculty members. Middle West and Northeast have more than 29% public governing boards whose presidents are also governing board members, mostly non-

voting members, although less than 11 percent of governing boards in West and South have such presidents. Middle West has a significant fewer governors being ex officio numbers despite voting or nonvoting.

4.4. Governing Board Trustee restriction

The trustee restriction is composed of four parts: political affiliation; region and state residence requirement in provision; and requirement of alumni inclusion. Compared with Northeast and South (Table 3, 5, and 6 in Appendix), West and Middle West have low possibility of political affiliation because they limit the number of members with any one political affiliation. In Northeast, governing boards can have relatively high political affiliation possibility. Most members don't have to be affiliated with governments. In the region and state residence requirement, Northeast seems to have distinctively low mean in the restriction of political affiliation and high mean in the region alumni requirement rate.

4.5. Governing Board Term and Remove Process

Table 4 presents three aspects of the term of trustees, including term length, term limit, and removal process. In terms of length, three regions have a similar term length of board members: West(5.33), Northeast(5.40), and South(5.48), while mid-West has a quite long term length(6.68) which is also supported by the post hoc test. In the case of term limit, governing boards in South have higher term limits contrasting to West. In the case of term removal process, Middle West presents significantly low mean when comparing to other three regions. It suggests that many governing boards in Middle West have no removal process (see Table 4, 7, and 8 in Appendix). Overall, Middle West region is salient in that it has a longer period and less removal process frequency in its boards.

5. Conclusion and Discussion

Using The Public Higher Education Boards Database designed by Association of Governing Boards of Universities and Colleges (AGB) in 2008, this paper investigated regional differences in boards' characteristics including board type, selection method, board composition, provision condition, term length. Three significant regional characteristics stand out. First, highly centralized state university governance with more political control differentiates West and Middle West from other regions. Eight of all the nine comprehensive state governance systems are implemented in West and Midwest, such as Utah, Kansas, and North Dakota. Besides, over 80 percent of trustees in West and Midwest are appointed gubernatorially, while the governor appoints only about 60 percent of trustees in other regions. Four states (Colorado, Michigan, Nebraska and Nevada) in West and Middle West have general public elections, while only one in other regions. Lowry (2001) showed that tuition pricing in states with "centralized" higher education governance is lower than "decentralized" states because "centralized" governance have more influence over university due to the political control of board membership. On the other hand, the

higher education system in these states is more relying on the state economic and societal situations. Comparing state appropriations among regions, after 2008 economic meltdown, states in West and Middle West decreased state appropriations more rapidly than other states did.

Second, Northeast, on the contrary, have more autonomous governing boards because of less centralized state governance structure, a higher percentage of alumni and self-perpetuating members, and more requirements on alumni participation rather than political affiliation. This institutional autonomy can be partially explained by the tradition of less governmental intervention in higher education and a significant number of elite alumni. Autonomous governing boards tend to understand the institutional situations better and make a decision based on institutional interests. Alumni impact is crucial to colleges and universities because formal and informal interconnections provided by graduates can make possible for institutions to have better chance to negotiate with the legislature, governor's office, foundations and corporations (Weerts & Ronca, 2007). In the challenging environment, Northeast governing boards are more flexible in facilitating alumni connection and enlarge the possibility of participation of members with political affiliation to adapt to political and financial changes (Weerts & Ronca, 2007).

Finally, the majority of governing boards have student members while faculty participation varies largely across regions with South and West having the highest participation rate. Although students are still considered as unprepared for trusteeship responsibilities, 70 percent of governing boards are willing to have one or two students; half of them are non-voting members. Including faculty members in governing boards is much more controversial. Some faculty members argue that they should sit on the board and point to the British pattern of faculty control. Governing boards, however, emphasize the inherent and inescapable conflict of interest because trustees must decide what is in the best interest of the institution as a whole, and faculty prerogatives (e.g. rank, salary, leaves, teaching loads, research). Besides, if considering conflicts of interest inside the faculty, the situation could be more dangerous and complex.

Historically, colleges and universities augmented with diverse purposes of the local community, denominational needs, and specific national policies. As Kerr & Gade(1989) notes, the provincial college was erected by a combination of government, church and lay people with personal fund raising and each institution and state has its history. Governing boards in many regions have developed in a different way and changed over time. However, colleges and universities in the same region share a similar experience in early history, and they prospered while depending on same resources and policy environment of their region.

We assumed that each four region might have different traits in their governing board operating ways. We tried to delineate overall traits of the U.S. universities' public governing board and to find out differences among them, however, there are limitations in our analysis. Including various kinds of representative on a board does not ensure good

communication and performance of governance. We could not find certain differences in board's type and trustee restriction. Given the performance of governing board is affected by many other reasons, we need to examine further by using the comprehensive method in the future.

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Appendix

Table 1. Governing Board Selection Method

Region	Average size	Percentage of Members Elected by:					
		Gubernatorially	Legislatively	General Election	Alumni	Self-perpetuating	Others
West	11	80	0	5	0	0	7
Middle West	10	84	2	5	1	0	4
Northeast	16	66	5	0	3	11	7
South	14	64	10	0	0	3	16
Total	13	70	6	2	1	4	10

Table 2. Governing Board Composition by Region

Region	Percentage of Governing Boards having:					
	Student	Faculty	President -voting	President-nonvoting	Governor ex officio-voting	Governor ex officio-nonvoting
West (N=46)	87	26	7	4	7	4
Middle west (N=66)	67	0	2	21	2	0
Northeast (N=55)	89	4	9	20	13	7
South (N=126)	56	27	2	1	19	0
Total (N=293)	70	16	4	10	12	2

Notes: In the original dataset, the composition of a governing board is set of dichotomous variables indicating whether a governing board has members in a certain category.

Table 3. Descriptive Information of Trustee Restriction

Region	Percentage of Governing Boards having trustee restrictions in:		
	Political affiliation	Region/State Residence	Alumni
West (N=46)	41	24	2
Middle West (N=66)	36	47	8
Northeast (N=55)	2	9	62
South (N=126)	17	32	13
Total (N=293)	23	30	19

Notes: In the original dataset, the trustee restrictions of a governing board is set of dichotomous variables indicating whether a governing board has requirements on trustees' political affiliation, residence, and alumni status.

Table 4. Descriptive Information of Term

Group	Length (years)		Term Limit (Frequency of Answering "Yes")	Removal Process (Frequency of Answering "Yes")
West				
Minimum	4		Yes (1)	5
Maximum	12		No (0)	41
Average(mean)	5.3	Average(mean)		0.1
Middle West				
Minimum	3		Yes (1)	15
Maximum	9		No (0)	51
Average(mean)	6.7	Average(mean)		0.2
Northeast				
Minimum	3		Yes (1)	16
Maximum	7		No (0)	39
Average(mean)	5.4	Average(mean)		0.3
South				
Minimum	3		Yes (1)	59
Maximum	12		No (0)	67
Average(mean)	5.5	Average(mean)		0.5

Table 5. ANOVA-test Results of Trustee Restriction by Region

Variables	Group	Sum of Squares	df	Mean Square	F	Sig.
Political Affiliation	Between Groups	5.568	3	1.856	11.771	0.000
	Within Groups	45.565	289	0.158		
	Total	51.133	292			
Regional Requirement	Between Groups	2.103	3	0.701	3.706	0.012
	Within Groups	54.662	289	0.189		
	Total	56.765	292			
State Residence	Between Groups	9.327	3	3.109	16.171	0.000
	Within Groups	55.561	289	0.192		
	Total	64.887	292			
Alumni	Between Groups	12.747	3	4.249	37.727	0.000
	Within Groups	32.55	289	0.113		
	Total	45.297	292			

Table 6. Post-Hoc Test (Sheffe) of Trustee Restriction

Variable	(I) region	(J) region	Mean Difference(I-J)	Std. Error	Sig.
Political Affiliation	West	Northeast	.395***	0.079	0.000
		South	.238**	0.068	0.008
	Middle	Northeast	.345***	0.072	0.000
Regional Requirement	West	South	.189*	0.06	0.022
		Northeast	Middle West	-.227**	0.079
		South	-.219*	0.07	0.023
State Residence	Middle	West	.404***	0.084	0.000
Alumni	West	Northeast	.530***	0.08	0.000
		South	.296***	0.067	0.000
	Northeast	South	-.234*	0.071	0.013
	Northeast	West	.596***	0.067	0.000
		Middle West	.542***	0.061	0.000
		South	.491***	0.054	0.000

Table 7. ANOVA-test Results of Trustee’s Term by Region

Variables	Group	Sum of Squares	df	Mean Square	F	Sig.
Length	Between Groups	81.286	3	27.095	9.468***	0.000
	Within Groups	827.055	289	2.862		
	Total	908.341	292			
Term Limit	Between Groups	5.432	3	1.811	8.905***	0.000
	Within Groups	58.766	289	0.203		
	Total	64.198	292			
Removal Process	Between Groups	7.748	3	2.583	11.763***	0.000
	Within Groups	63.453	289	0.22		
	Total	71.201	292			

Table 8. Post-Hoc Test (Sheffe) of Trustee’s Term

Variable	(I) region	(J) region	Mean Difference(I-J)	Std. Error	Sig.
Length	MW	West	1.356**	0.325	0.001
		Northeast	1.282**	0.309	0.001
		South	1.206***	0.257	0.000
Limit	South	West	.360***	0.078	0.000
		Middle West	.241**	0.069	0.007
Removal Process	Middle West	West	-.314*	0.09	0.008
		Northeast	-.370*	0.086	0.000
		South	-.411*	0.071	0.000

Developing engineering students' engagement with Circular Economy practices

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Abstract

The Circular Economy has become a topic of high interest for policy makers, scholars, and business managers because it is shown as a new paradigm to achieve the sustainability of our society. However, the main efforts in Circular Economy cannot be reduced to professional or experts' acts. Nevertheless, we consider that if we pretend to meet the current needs without compromising the ability of future generations to meet their own needs, we have to teach present generations the principles to achieve the economic, social and economic sustainability in the short and long term. This paper enhances the use of guided and official student clubs at the university to teach and engage engineering students with the Circular Economy practices.

Keywords: *Higher education learning, circular economy, green day, sustainability, Sustainability education*

1. Introduction

Current consumption and growth patterns are leading society on a highly unsustainable path, which is increasingly damaging the ecosystem and endangering the provision of resources and ecosystem services (Robèrt et al., 2004). Today's linear industrial model implies a need for a model that uses less raw material and is more aligned with the cyclical nature of Earth. A concept that claims to provide such a model is Circular Economy (CE). Therefore, this concept can potentially address the sustainability challenge by reducing resource extraction and waste streams, and support businesses in moving towards sustainability. Adopting circular business models that seek to support the planet resilience could present an attractive win-win-win situation for society, the environment and the company itself. In the long-run, this transformation could offer an essential competitive advantage as CE claims to create more value from resources, support companies in meeting changing market requirements, lowering environmental costs, increasing consumer convenience and securing supplies (Preston, 2012).

Since the Agenda 21, an action plan for achieving the sustainable development, delivered at the Earth Summit in Rio de Janeiro in 1992, it has been globally accepted the education capacity to promote the sustainable development in people behaviors to address sustainable development issues (UN, 1992). Nonetheless, the literature about the integration of sustainability concepts and circular economy in higher education and university curricula is still limited. Preston (2012) claims, school and university students are the ones that are going to be the innovators of the next decades, what means that university lecturers have to ensure to transmit the students the necessary knowledge about sustainability and circular economy so they will be able to implement in the near future the corresponding actions. An important initiative is being developed by the International Baccalaureate® (IB), a non-profit educational foundation which offers respected programs of international education, has announced that they are collaborating with Ellen MacArthur Foundation to embed systems thinking and a circular economy perspective into the IB curriculum (IB, 2016). Moreover, universities have increased the offer of academic programs related to sustainability and environmental sciences like Delft University of Technology. For instance, a survey in the United States identified 840 degree-granting programs at 652 institutions that offer 1183 interdisciplinary environmental degrees (Vincent, 2009).

Then, companies are responding to the schools and universities efforts, Goel (2005) enhanced that engineers awareness of environmental issues is an appreciated skill in Indian companies, over and beyond other skills such as social skills, specialized engineering proficiency or Project management skills. However, authors like Azapagic et al. have provide evidence of the low level knowledge and understanding of environmental and sustainability issues by engineering students from 21 universities based in Europe, North and South America, the Far East and Australia. Consequently, the objective of this research

is to increase engineering students' engagement with Circular Economy as a valuable skill to act as a social agent in their further professional performance, from their activity in firms or governmental institutions. Moreover, this work contributes to existing knowledge in sustainability learning by providing a detailed case of engineering students who have learnt about circular economy with real and innovative actions out of the class room such as the design, organization, performance and the greenday assessment. Therefore, these kinds of experiences have a higher impact in the students' motivation and engagement (Blumenfeld et al., 1991).

2. Method

This research has been carried out with the students from the University of Navarra, particularly with the Engineering School (Tecnun) students. At Tecnun, different subjects are taught in which the environmental sustainability is treated, but it has been believed more effective that the students acquire the competencies through an activity that can be projected to the whole campus. In this way, Cardona & García-Lombardía (2005) enhance that a learning activity is more effective if it is complemented with knowledge transmission, coaching, and training. Thus, real actions are more visualized and more people might be aware of the importance of sustainability. In order to link the activity to a topic of knowledge, the "Green Day" activity was developed within the Environmental Technology subject for the industrial management degree students and the industrial design students. This event was one of more than 30 academic events directly related to the environment and sustainability that took place at 2016 in the University of Navarra (in its four campuses of Pamplona, San Sebastián, Barcelona y Madrid).

The purpose of the Green Day was that students could become aware of what they caused to the environment. A total of 45 students decided to organize the Green Day. These students had one session about Circular Economy, so they could better understand the importance of taking care of the environment and this way it would be easier that they involve other students in this day. After the session, the students thought about possible activities to organize the Green Day. The list of activities that the student organizers had to prepare were the following ones: bicycles' paths, communication, sponsors, flea market and workshops.

3. Results

3.1. Bicycles

The bicycles group (9 leaders) created three different routes from different parts of the city to come by bike. As for what that day is concerned, they divided themselves between the different points of departure and each one was responsible for being at the defined time in the place to wait for the rest of the people. Although they would have liked more people to participate, progress was made with respect to last year, achieving a group of 25 people without including the people who did not join the routes but arrived on their own by bicycle due to scheduling reasons (Figure 1). Along the way, they took photos and videos and they sent them to the communication team. To encourage this sustainable transport, the participants receive a ticket to participate in a raffle for a prize.



Figure 1. Students arriving at the university

3.2. Communication

The organizers (4 students) were in charged of communicating and the disseminating this event. In the first place, they made several posters related to that day in which the different activities and events were exposed. The posters referred to the different activities that their colleagues had organized for the Green Day.

They also talked to the university communication department so that all the information related to the Green Day could appear on the different digital and social platforms of the university. In order that every student at university participates in this experience, they contacted the different delegates of each course and degree. Finally, they took photos of all the activities that were published in the blog of the Sustainable Improvement research group¹.

¹ <https://tecnundoi.wordpress.com/2016/11/03/comunicado-estudiantil-dia-verde28-de-octubre/>

3.3. Sponsors

As organizers of getting sponsors, this group of seven students contacted a total of 19 companies. In exchange, they gave them the possibility of giving their company visibility on posters, brochures and in the workshops. The sponsors were in charge of providing prizes for increasing the level of participation in different activities. They contacted a total of 19 companies and organizers only had a positive response from 4 companies. The prizes were: 3 lots of products from Organic49, an ecological supermarket; a batch of Carrefour Express products; a dinner for two in the restaurant Munto Berri; and 10 tickets to the San Sebastian Aquarium. The two first sponsors' products were used as prizes of the different workshops, whereas the dinner and tickets for the Aquarium were raffled between the bicycle participants or people that bought tickets at the flea market.

3.4. Flea Market

The eleven students of this group were in charge of organizing a green market, with the aim of collecting second-hand items, selling them to give them a new use and encourage a sustainable behavior among the students. For this and throughout the week, they informed through posters and images on the Tecnun screens this activity, asking for students and workers collaboration bringing objects that they were not using anymore. They placed two large cardboard boxes at the entrance of the main building, where they could deposit everything they brought. They could bring anything except clothes as they found it more difficult to sell it among students and teachers of the School. The social objective of the flea market was to raise money to give it to the refugees through an NGO association. They were aware that everything was not going to be sold, so it was decided that the objects that were not sold would go to Caritas.

In addition, organizers decided to sell tickets for a raffle (the same as the bicycle participants) for a cost of one euro. Early in the green day morning, several students were in charge of setting up the tables and placing all the objects collected on them. A total of four tables were needed to place all the objects. Once the objects were placed, they were priced. They also asked the finance department € 20 in € 1 and € 0.50 coins to have changes.

Tickets were also very successful. Along with the objects, 223 euros were collected. Not only students but also employees participated in the flea market. The general impression was that the bags were the least successful objects. On the other hand, the fountain pens had a great level of acceptance as they were in very good condition and were very original.

3.5. Workshops

Three different workshops were prepared: recycling paper, designing a more eco-friendly campus, designing objects with plastic bottles. Around 30 people participated in the workshops. Regarding the activity of recycling paper, the process was as follows. First, they cut the paper into small pieces and put all the paper in a bucket of water. The participants mixed it with the hand, and then they made a dough with the mixer. After this, they distributed the dough obtained in another bucket that contained water and they re-mixed everything with their hands. Each team took one pair of frames and placed the one that had no grate on top of the other, leaving the grate in the middle. The frame was put into the bucket and a layer of dough was placed inside the box of frames, and then the water was drained out, pressing the hands over the dough. Once they had removed most of the water, they removed the frame without a grid, placed a piece of a t-shirt on the paper, and on a wooden plank. After turning the whole (as if from a potato omelete it was) they repeated the process on the other side. Before plugging one of the sides of the paper with the cloth and board, each team took some tree leaves and put them on the recycled paper obtained and decorated it. Once the paper was covered, a person was placed on top to get it flattened and waited a while. In order to choose the winners of the group, the homogeneity of the mass and the decoration was valued (Figure 2a).



Figure 2. a) Recycling paper activity winners , b) Students designing objects with plastic bottles

The second workshop consisted of thinking about what we would change from the campus to make it more eco-friendly in the future, in 2050. For this activity, they used a Design and Creativity technique called Nominal Group Technique (NGT). This technique is an alternative of brainstorming (Sample, 1984), consequently, the students proposed ideas like Electric cars, renewable energy use, organic garden, use of ecological materials, more green spaces, natural light, and more training related to sustainability.

Regarding workshop 3, they thought of making gift packages and purses/cases with used plastic bottles. To get the materials they did a collection of bottles on the campus and they designed a poster to leave their used plastic bottles in a cardboard box that they placed at the entrance of the main building (Figure 2b). The zippers and decorations (bow, tissue

paper, stickers) they were bought, and the glue to paste everything was borrowed from university, as well as the scissors to cut all the materials. Most people preferred to make cases/purses rather than gift boxes, as it was more useful. It was amazing how people, even with few materials managed to create different objects, creative, colorful and very useful at the same time.

At the end of the workshops, there were 3 lots of products made of Carrefour Express and Organic49 products to be handed to each of the winners of the different workshops.

3.6. Students satisfaction with the Green Day

At the end of the Green Day, the students' organizers (41) answered a satisfaction survey with the aim to assess on a scale from 1 to 5 the general impressions and knowledge acquired with the Green Day. Fortunately, the students had a positive feeling in average; they especially assigned high scores to the question related to the social skills they could develop with their own partners and friends and an important majority feels comfortable to develop and participate in new activities related to the environmental awareness. On the other hand, students expressed some reservations regarding the sustainability improvement on campus in short and long term.

Item	Question	Score
1.	I believe that the activity carried out has given me the knowledge and confidence necessary to participate in other activities aimed at sustainability and environmental improvement.	3,41
2.	I believe that the activity I have done has been useful in learning environmental sustainability issues.	3,41
3.	The approach of this activity has been agile, dynamic and effective.	3,73
4.	I believe that the activity carried out will make it possible to achieve sustainable (long-term) solutions on campus.	2,83
5.	I believe that the practices, techniques, and tools used within the activity have been adequate.	3,78
6.	After doing this activity, I feel able to develop and participate in other environmental improvement activities.	3,63
7.	Participation in this activity will improve sustainability on campus.	2,93
8.	Participation in this course will allow me to improve my skills.	3,22
9.	Participation in this course will help sensitize students to environmental sustainability.	3,17
10.	Participation in this activity will help me in my professional and personal development.	3,17
11.	I think the organization of the event has been clear and easy.	3,63
12.	I believe that the activity carried out will help me to improve the good atmosphere among my colleagues.	3,80
13.	I think my colleagues see this activity as something positive.	3,88
14.	It seems to me positive that more partners participate in this activity.	4,17
15.	In general, I am satisfied with this course.	3,71

4. Conclusion

All the organized activities were useful and innovative in the university, as they increase the environmental awareness of students at the campus and as a professional skill. In addition, the green day activities are alternatives to reduce pollution in the environment and proved that it is not very complicated to carry them out. Coming by bike or car sharing does not require any incredible effort. Using waste materials to create new products is an activity that can be carried out by all at our homes. And resell products that are no longer used in the flea market to minimize waste proved that both parties benefit from the sale.

If we continue this way and every year the outdoors activities are improved and even a new one is added, the participation will increase and the impact will be greater both in the students and in the teachers of the school. Consequently, some students have developed their environmental awareness through real actions, instead of traditional courses, and university lecturers had the opportunity to innovate in the way they teach the applications of sustainability and circular economy. The Green Day is key to being able to remind the academic community and future professionals, year after year, that we have to improve our behavior according to the role we have and the quality of life that we carry because it can affect our environment.

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Assessing resilience at University

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Abstract

Promoting quality results also requires the ability to measure outcomes and to identify what context variables can affect the student's success. The aim of this work is to analyze the distances in terms of the results obtained to a test on generalist skills among students with different family background (advantaged vs disadvantaged) and with brilliant performance, verifying whether these differences are significant. The analysis suggest that for resilient, the social background does not predict the student's performance, thus we suppose that the skills achieved during the University studies could contribute to the reduction of the distance among students with different social background.

Keywords: *learning outcomes assessment; equity; resilience; higher education.*

1. Introduction

The Prague Ministerial Conference (2001) showed the need to offer more details on the results of each University cycle. To this end, a group of specialists in higher education has defined the set of Dublin descriptors, defining which general knowledge and skills every graduate should possess at the end of each cycle of tertiary studies (Joint Quality Initiative, 2004).

In 2005, the Italian Ministry of Higher Education defined the Italian Qualifications Framework. According to that, upon completion of the first cycle graduated students should:

- have demonstrated knowledge and understanding in a field of post-secondary education and is typically at a level that, whilst supported by advanced textbooks, includes knowledge of some latest developments of their field of study;
- apply their knowledge and understanding in a manner that indicates a professional approach to their work, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study;
- have the ability to gather and interpret relevant data (usually within their field of study) to make judgments that include reflection on relevant social, scientific or ethical issues;
- communicate information, ideas, problems and solutions using both a specialist and non-specialist language;
- have developed those learning skills that are necessary to undertake further study with autonomy.

Thus, promoting quality results also requires the ability to measure outcomes and to identify what context variables can affect the student's success.

2. Research objectives

During the last forty years, several studies have tried to identify which factors could influence student's performance: the shared finding of these studies lead to the family background that, in some way, can affect their success.

However, in the current scientific literature there are few studies that examine the performance of "resilient" students, that is those who have a disadvantaged socio-economic background, but achieve school success (Lombardi, Agasisti, 2012). Fewer are the studies that analyze the student's performance at the tertiary level. Notably, the PISA data (OECD,

2013) showed that, during 2003-2012, Italy recorded a significant increase in the number of resilient students.

The aims of this work is to analyze the distances in terms of the results obtained to a test on generalist skills among students with different family background (advantaged vs disadvantaged) and with brilliant performance, verifying whether these differences are significant.

3. Methods

The assessment of the learning outcomes of Italian graduates through a test, conducted by the Italian National Agency for the evaluation of Universities and Research Institutes (ANVUR), has set the ambitious goal of measuring the levels of critical thinking and written communication achieved by Italian undergraduates (Benjamin et al., 2013).

CAE's Collegiate Learning Assessment (CLA+) is a performance-based assessment that measures higher-order thinking skills at the tertiary level within the United States and internationally. It consists of two sections, a Performance Task (PT), which requires students to generate a written response to a given scenario, and selected-response questions (SRQs). CAE collaborated with ANVUR to conduct two pilot studies from 2012 to 2015: in both cases, ANVUR selected one CLA+ International test to be translated, adapted to Italy and validated by a sample of Italian students. This process ensured that the test was as much as possible analogous and equivalent to the American version. ANVUR pretested the translated and adapted test and conducted a series of cognitive labs in April of 2013 and 2015. The final result was rebranded as TECO (TEst sulle COmpetenze). For its nature, the same test was administered to students regardless of the course of studies in which they were enrolled.

To ensure whether and how some background variables (e.g. demographic, territorial and related socio-economic and cultural background) can affect the TECO results, ANVUR proposed a questionnaire at the beginning of the test.

This study is based on the responses given to this questionnaire, taking into account the results obtained in the first section of TECO (Performance Task, PT). This test presents a problematic scenario, in which the student has to propose a possible solution through the use of a number of documents provided (Blog, Podcast, research reports, newspaper articles and interviews). The student is not required only to assess critically the situation and texts, but also to explain effectively its solution to the problem (Benjamin et al., 2013, p.5).

The PT section measures three specific abilities:

- Analysis and Problem Solving (APS);
- Writing Effectiveness (WE);
- Writing Mechanics (WM).

Each student receives a score from one to six for each of these three abilities according to a defined scheme. A score of N/A was assigned to students who did not answer the prompt or whose responses were off topic. The student responses were randomly and anonymously assigned to two different scorers, identified within the teaching staff of each university (24 universities) involved in the TECO, review each written response in double-blind: they do not have information about the student nor the scores assigned by the other scorer. For any double-scored response that was inconsistent (i.e., the difference between the two total scores was greater than 3 points or the difference between two sets of subscores was greater than 2 points), the elaborate received a third correction by ANVUR supervisors.

4. Participating students

The eligible students for TECO 2013 (ANVUR, 2014) were those enrolled in the 3rd or 4th year of a three-year course or single-cycle master's course who had acquired all the necessary study credits (basic and characterizing). For the TECO 2015 (ANVUR, 2016), some changes were adopted: students had to be in their 3rd consecutive year enrolled at the university; students enrolled in a three-year first-cycle course, must have acquired 75% of the basic and characterizing study credits required by the course class; students enrolled in a single-cycle master course must have acquired at least 90 (from a total of 120) basic and characterizing study credits. Students who participated in the 2015 edition of TECO were 6586, but for this study we are taking into account only those 2085 students whose elaborate have received three separate corrections, considering the final score as the average of the three.

5. Results

The following analysis (table 1) show the correlation coefficients for the PT subscores (Analysis and Problem Solving, Writing Effectiveness, and Writing Mechanics) and the total score, showing that correlations are significant reliable (level>.01).

Table 1. Correlations among PT subscores

		APS	WE	WM	PT
APS	Pearson's	1	.707**	.483**	.861**
	Sig. (2-code)		.000	.000	.000
	N	2085	2085	2085	2085
WE	Pearson's	.707**	1	.588**	.900**
	Sig. (2-code)	.000		.000	.000
	N	2085	2085	2085	2085
WM	Pearson's	.483**	.588**	1	.800**
	Sig. (2-code)	.000	.000		.000
	N	2085	2085	2085	2085
PT	Pearson's	.861**	.900**	.800**	1
	Sig. (2-code)	.000	.000	.000	
	N	2085	2085	2085	2085
** P < .01 (2-code)					

We calculated the highest occupational status of parents (HISEI) and the highest educational level of parents converted into years of schooling (PARED) based on the Index of Economic, Social and Cultural Status (OECD, 2012). Table 2 shows the correlation with PT subscores.

Table 2. HISEI and PARED correlations with PT subscores

		APS	WE	WM	PT
HISEI	Pearson's	.057**	.058**	.061**	.069**
	Sig. (2-code)	.009	.008	.005	.002
	N	2085	2085	2085	2085
PARED	Pearson's	-.026	-.034	-.043*	-.040
	Sig. (2-code)	.236	.117	.050	.067
	N	2085	2085	2085	2085
** P < .01 (2-code)					
* P < .05 (2-code)					

We then synthesized them through Principal Component Analysis into a single index, defined *Background*. The correlations with the test scores were then verified (Table 3).

Table 3. HISEI and PARED correlations with PT subscores

		APS	WE	WM	PT
Background	Pearson's	.041	.050*	.049*	.054*
	Sig. (2-code)	.061	.024	.026	.013
	N	2085	2085	2085	2085
** P < .01 (2-code)					
* P < .05 (2-code)					

In order to measure the effect of the family background for the Italian undergraduates and estimate the differences in their performance using the Background index, the sample was divided in two groups of students, namely disadvantaged and advantaged students. This operation required a selection of the two extremes of the distribution of the Background index: students with high background values (over the 66th percentile) are defined Advantaged (Group 1); students with lower background values (below the 33th percentile) are identified as Disadvantaged (Group 2).

The intensity of the Background effect (independent variable) on students' abilities (dependent variable) is calculated by linear regression. The residues of the regression allow to identify three sub-groups, as reported in table 4.

Table 4. Six sub-groups according to Background index and TECO performance

Percentile	Group 1 – Advantaged	Group 2 - Disadvantaged
Over the 66	<i>Advantaged Top Achievers (ATA)</i>	<i>Disadvantaged Top Achievers (Resilient) (DTA)</i>
65° - 33°	<i>Advantaged Medium Achievers (AMA)</i>	<i>Disadvantaged Medium Achievers (DMA)</i>
Below 33°	<i>Advantaged Low Achievers (ALA)</i>	<i>Disadvantaged Low Achievers (DLA)</i>

4. Results and conclusions

Data show that in the Disadvantaged group, the distances between resilient (DTA) and low achievers (DLA) are large and significant for the total PT score, for the three subcategories (APS, WE, WM), as well as for the two extremes subgroups (ALA and ATA) of the Advantaged students. However, taking into account the distance between the resilient (DTA) and advantaged students with brilliant performances (ATA), we show that the gap is not existent. In addition, the two sub-groups achieve very similar scores, suggesting that, at least for the resilient, background does not affect their success.

Table 5. Distances between student's sub-groups

Disadvantaged Background		APS	WE	WM	PT	Advantaged Background		APS	WE	WM	PT
Disadvantaged Low Achievers	Mean	2.22	2.17	2.65	7.03	Advantaged Low Achievers	Mean	2.17	2.24	2,71	7,12
	N	358	358	358	358		N	261	261	261	261
	E.S.	.030	.029	.034	.057		E.S.	.034	.037	.037	.066
Medium	Mean	3.01	3.06	3.40	9.47	Medium	Mean	3.05	3.04	3.42	9.51
	N	267	267	267	267		N	245	245	245	245
	E.S.	.027	.022	.033	.031		E.S.	.029	.024	.036	.032
Resilient	Mean	3.88	4.00	4.17	12.06	Advantaged Top Achievers	Mean	3.98	4.05	4.18	12.20
	N	180	180	180	180		N	167	167	167	167
	E.S.	.049	.043	.043	.088		E.S.	.059	.049	.043	.109
Total	Mean	2.85	2.87	3.24	8.96	Total	Mean	2.94	2.98	3.33	9.25
	N	805	805	805	805		N	673	673	673	673
	E.S.	.030	.031	.030	.077		E.S.	.035	.034	.031	.086
	Sign.	.000	.000	.000	.000		Sign.	.000	.000	.000	.000

To graphically show this conclusion, all the upper and lower limits for the PT average score of each sub-group have been calculated. To obtain an error probability of 5%, parameters have been calculated to be included in the $\pm 1,96 * E.S.$ range. Results (see Figure 1) show that the differences between groups are significant. However, there are no significant differences between the Low Achievers (Disadvantaged and Advantages), Medium Achievers (Disadvantaged and Advantages) and Top Achievers (Resilient and Advantaged) sub-groups.

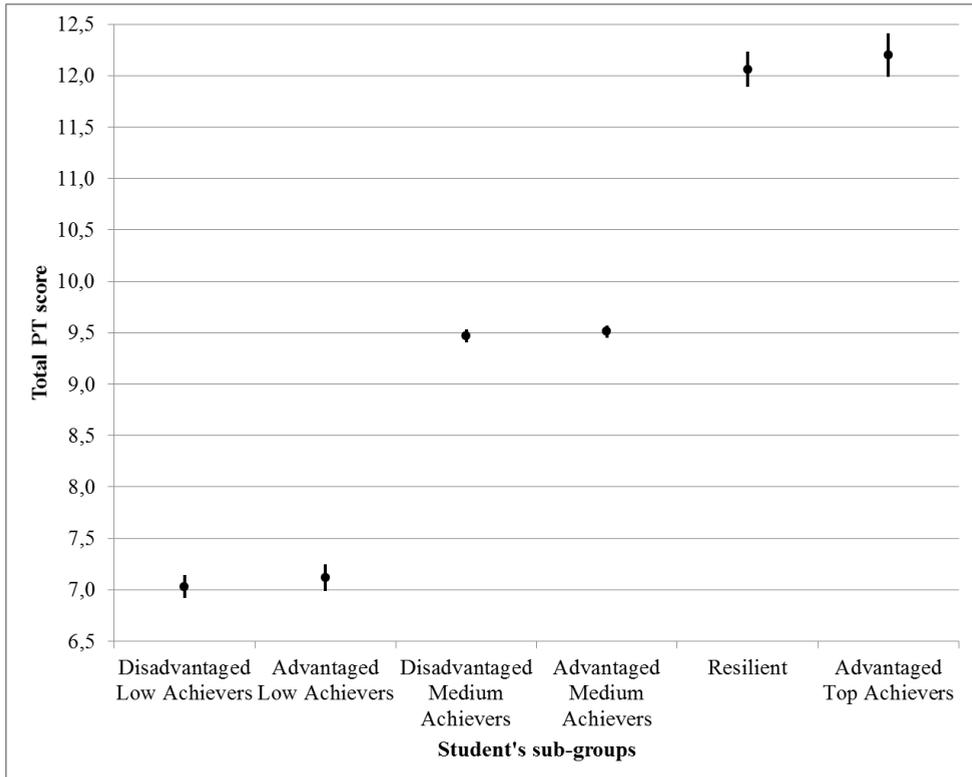


Figure 1. Distances between student's sub-groups

The analysis suggest that for resilient, the background does not predict the test performance, thus we suppose that the skills achieved by students graduating from the Italian higher education system, could contribute to the reduction of the social distance among students with different social background.

We believe that the study of student's resilience could be an instrument to help the definition of new policies with the aim to increase disadvantaged student success, thus, increasing the overall equity of the tertiary education system. Universities, in this perspective, will have the role of "resilience catalysts".

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Online Students' Expectations Differ: The advantage of assessing students' expectations in online education

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Abstract

Student feedback on online education has become of major importance for many higher education institutions. While researchers already identified students' success factors and analyzed student satisfaction in online study programs and courses, the role of expectations in students' online educational experience has been very often neglected in previous research. Our study adds here as it captures students' expectations at the beginning of an online study program, highlighting the differences to traditional on-campus students. Our results reveal that expectations of on-line students differ from the expectations of on-campus students and must therefore not be confused. Furthermore, the assessment of student expectations is not only a way to consider and satisfy student needs in order to improve online programs or courses, but also a means to track the institutions own performance.

Keywords: *Online education; student experience; expectations; retention; higher education management.*

1. Introduction and Background

Literature reveals that it is mainly the interplay between students on one hand and the institution on the other, which determines success or failure in online education and thus the passing or non-passing in an online degree course or program. Furthermore, prior studies showed that students enrolled in online courses or programs are influenced by a lot of different factors which determine their level of satisfaction, as well as the success and the degree of retention. Students backgrounds such as age, ethnicity and former education, as well as personal or external factors as job and family responsibilities, and the financial situation for example have been identified as such influencing factors (Rovai, 2003). Furthermore, student skills such as time-management, self-management, motivation, commitment, cognitive and intellectual skills, their study skills and learning styles play a substantial role influencing on student success and satisfaction in online education (Bitzer & Janson, 2015; Eom & Ashill, 2016; Rovai, 2003). Moreover, interaction links the institution on one side and the student on the other, and is therefore seen as an additional crucial factor (Bitzer & Janson, 2015; Eom & Ashill, 2016; Rovai, 2003).

The influence of students' expectations at the beginning of an online degree program or course on satisfaction and success has been overlooked to a great extent within the context of higher education (Appleton-Knapp & Krentler, 2006). There is however evidence that students who take the same course, collaborate in the same working group and receive the same grade; differ considerably in their levels of satisfaction after the completion of the course. This is at least partly due to students' prior expectations (Appleton-Knapp & Krentler, 2006). Within the online education context, the study by Appleton-Knapp & Krentler (2006) provides evidence that to understand student satisfaction fully, examining and knowing students' expectations is crucial. Finally, the study of Yukselturk & Bulut (2007) found evidence for the link between students' expectation, satisfaction and success in online settings, as results reveal that an underestimation of study time and -effort, is often a reason why students actually fail in online courses.

These findings are perfectly in line with the assumptions of the Expectancy Theory by Vroom (1964). Expectancy Theory is a prominent theoretical approach to address expectations and to discover and understand why individuals behave in a certain way or another (Eerde & Thierry, 1996; Vroom, 1964; Vroom & Deci, 1989). It explains that individuals are more motivated to behave in a certain way if they expect a positive perceived outcome (positive expectations) and less motivated to perform in another if they expect a negative perceived outcome (negative expectations). Hence, students with positive expectations might be also more motivated to complete a study program. In addition, the Confirmation/Disconfirmation paradigm by Oliver (1980, 1997) can be used to understand the relationship between expectations and actual performance and the subsequent customer satisfaction or dissatisfaction in more detail. If students are seen as customers and their

expectations are not met, it can be assumed that they tend to become unmotivated, are less satisfied and more likely to drop-out in turn (DeShields Jr, Kara, & Kaynak, 2005; Oliver, 1980; Rust & Oliver, 1994; Vroom, 1964).

Intervening and addressing students' study experience properly becomes difficult however, if higher education management is not aware of students' expectations at the beginning of an online study program or assumes them to be equal to on-campus students' expectations. Hence, our study tries to address the topic of students' expectations, looking in particular at assumed and anticipated challenges and fears at the beginning of an on-line degree program compared to the challenges and fears in on-campus programs.

2. Method

We collected data from two cohorts of freshman students at an Austrian business school over a period of three years (2014 – 2016). Students of the first cohort are enrolled in an Online Bachelor Degree Program of Business Administration (online cohort) and students of the second cohort are either enrolled in the Bachelor Degree Program of Nonprofit, Social & Health Care Management or Business and Management (regular cohort), both of these programs are conducted as traditional on-campus programs. A questionnaire with standardized open questions asked all freshman students to assume and anticipate challenges for their further studies. The questionnaire also included questions regarding expected success strategies. All students were asked to answer and return the questionnaire in written form. As our study focuses on online students' expectations which are socially constructed, subjective, as well as multiple and changeable (Denzin & Lincoln, 2011; Lincoln, Lynham, & Guba, 2011), data was analyzed according to the content analysis approach by Mayring (2000). The coding and evaluation were supported by the software MaxQDA, following a combination of deductive (codes derive from theory) and inductive (codes derive from data) approaches. Furthermore demographical data as age, nationality, gender, and former education has been collected independently from the qualitative study of both groups and has been analyzed quantitatively.

3. Results

The quantitative evaluation of the demographical data reveals that online students are on average older than on-campus students and around 28 and 29. Furthermore, the variation of backgrounds, nationality and former education is much richer in the online student cohort compared with traditional on-campus students. Online students come from 12 different countries and mostly have or have already had work experience, vocational training, university- or higher education contact points.

Findings show that both types of students especially expect challenges regarding time- and self-management. The issue of work-life-study balance (WLB) has been mentioned frequently as major challenge from the online student cohort. In contrast, on-campus students are more worried about not being able to meet deadlines and express concerns about the increase of the overall workload and its consequences such as overload and stress. They are afraid that there might be no more free-time to relax and they also assume that motivation will decrease in turn. Moreover, online students mentioned that they are insecure and worried about 'learning to learn' again. Hence, many online students expect problems regarding initiating studying and learning, finding a suitable learning style, as well as regarding understanding of contents. On-campus students on the other side reported fears regarding exams and the amount of learning, and the multitasking between different subjects and contents. Furthermore they were very often also concerned about the language and expect linguistic difficulties if the study program is offered in English. Additionally, online students were not that sure about the practical relevance and the applicability of what will be studied during the study program. They expected in turn that the implementation and the integration of content learned into the workplace or a connection to the own interest area will be difficult. On-campus students did not report this problem at all. Moreover, students reported concerns regarding interaction and collaborative learning. While on-campus students are worried about the task of working in groups and the group grading, online students are insecure about the creation and cultivation of social contacts with peers and lecturers and interactive communication in general. Besides, online students are sometimes skeptical regarding the processes, the quality and the value of a study program conducted online. Few of them also reported that their environment is skeptical about the legitimacy of the program and that they struggle to justify themselves in front of family and bosses why they opted for an online program. Moreover, they often emphasized how important family and employer support is for their further studies. This was no topic in the on-campus cohort.

4. Discussion

Our results reveal that online students expect indeed to struggle with some of the same issues as traditional students. Taking however a closer look, some interesting variations can be discovered.

Time- and self-management are for example expected to be major challenges from both groups. However, in contrast to on-campus students who are more concerned about more than one exam taking place at the same day or not having enough free time for example, online students expect problems in balancing work-life and study. Nearly all of them have a full-time job and family-responsibilities and are therefore even more challenged to manage study demands and to fulfil outside obligations at the same time. Therefore, they also mentioned that the support of the family, as well as from the employer will be extremely important.

Substantial differences can also be observed regarding the expected challenges of study skills and learning strategies. While on-campus students expect to have to struggle with the amount of learning and are worried about having to express oneself in a foreign language as the program is offered in English, online students are more concerned about starting to learn again. Online students think about how to find the optimum learning style, and thus look at the topic from a very different perspective - rather than considering details they keep the focus on the big picture. Hence, it can be assumed that they are looking at this challenge in a more neutral and objective manner. Meanwhile, traditional students do not seem to reflect that much about this issue, as they are younger and expect challenges regarding study skills probably to be similar as to ones recently experienced in high school. They study from exam to exam, but tend to not to reflect on learning styles.

Moreover, the desire of online students to connect the content learned to their work or private lives stands out in the comparison between traditional on-campus students. This emphasizes again the assumption that they tend to focus more on the big picture and the overall value of the study program. On the other hand, traditional on-campus students do not have the expectations of applying newly learned skills into their work environment presumably as they are not working and are in fact full time students.

This difference can also be replicated looking at collaborative learning and interaction. Whereas on-campus students are rather negatively biased towards group assignments in class and their outcomes, online students are concerned to have no contact to peers at all. Hence, both groups see collaborative learning and interaction as an issue but online students tend to be more concerned about not being socially integrated, whereas on-campus students tend to be more worried about close collaboration with peers during their studies.

Furthermore, public acceptance seems to be a big issue for online students, but no issue at all for on-campus students. Online students actually study and invest the same time and effort as on-campus students do but are actually often not rewarded with the same respect. Hence, it seems that official acceptance of online education is sometimes still lower and not only an issue for students making use of - but also for institutions offering online education and their legitimacy.

Considering Expectancy Theory by Vroom (1964) and the Confirmation/Disconfirmation Paradigm by Oliver (1980, 1997), expectations can influence and reflect actual needs of online students and should therefore not be ignored when designing online educational offers. As our results reveal they can be used as important signposts for higher education institutions which still hesitate to implement online education, as well as for institutions which already implemented it. Moreover, support and feedback services in particular may be important to shape unrealistic expectations (Diaz, 2002; Howell, Williams, & Lindsay, 2003). Especially the training of students in time- and self-management might be an expedient way to motivate and support students to succeed in an online study program, as already proposed by other authors (Mandernach et al., 2006; Moessenlechner et al., 2015; Muilenburg & Berge, 2005). Moreover, work-life balance is a very prominent topic within our results and should be addressed from higher education institutions therefore. In this regard, aspects such as flexibility of deadlines and attendances could be reconsidered, as well as the possibility to introduce blocked courses, and weekend classes for example. In addition, support services as nurseries, but also financial assistance can facilitate the study experience for online students significantly. Hence, taking a closer look at the expectations at the beginning of on-line students compared to on-campus students we see that there are various different forms of expectations which must not be confused. Therefore, as other authors before (Oblinger, Barone, & Hawkins, 2001), also we call upon the consideration of these differences and recognize that developing and designing an online program embraces different educational services regarding components, curricula, pedagogy and even marketing compared to on-campus students. Furthermore, in line with the authors Cheung & Kan (2002) we recognize the importance of diversity within the online student population itself and the need to identify individual student characteristics in order to be able to design and develop online programs and courses in line with the needs of the audience. Hence, we claim that not only success factors have to be considered when looking at the problems of drop-out rates and retention, but satisfaction as well. Students satisfaction can be partly also explained by their expectations and therefore we emphasize the need to assess online students' expectations in order to increase students' satisfaction. This contributes not only to the completion and the passing, but even more to a 'successful' completion of the online study program as the whole study experience, from the beginning to the end, can be referred to a positive event. Even more so this will be of relevance for the institution itself. Students will evaluate the educational experience not only in terms of

passing or non-passing a course or program, but they will consider their whole study program and if they were satisfied or not. Hence, students' feedback might be richer which is again an advantage for the institution and the assessment of its own performance as well as for the benchmark with other competitors in the industry. Finally such a novel approach in assessing students' expectations at the beginning of an online program, could be even seen as competitive advantage and should be therefore fostered and strengthened from a strategic point of view.

5. Conclusion

Online students' expectations and needs may appear similar to traditional on-campus students' expectations. Nevertheless they differ from on-campus students' expectations in some main points. Therefore a separate assessment is needed and useful in order to develop, design and implement online education successfully. Furthermore, this study highlights the role of expectations which have to be considered as they have an impact on student satisfaction which in turn influences student retention and also the reputation and the image of the educational institution itself. Thus, our study does not only show the importance of the assessment of students' expectations for the successful completion of an online study program, but it emphasizes its advantages for the institutions and its position in the market from a strategic point of view as well. Student feedback on expectations enables higher education institutions to assess their own online offers in order to explain and understand student retention and to improve the design and implementation of technology enhanced learning. Furthermore it is not only a way to consider and satisfy student needs in online programs or courses, but also a means to track the institutions own performance (Bitzer & Janson, 2015; Eom & Ashill, 2016; Gibson, 2010).

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An Investigation into Third Level Module Similarities and Link Analysis

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Abstract

The focus of this paper is on the extraction of knowledge from data contained within the content of web pages in relation to module descriptors as published on <http://courses.itb.ie> delivered within the School of Business in the Institute of Technology Blanchardstown. We show an automated similarity analysis highlighting visual exploration options. Resulting from this analysis are three issues of note. Firstly, modules although coded as being different and unique to their particular programme of study indicated substantial similarity. Secondly, substantial content overlap with a lack of clear differentiation between sequential modules was identified. Thirdly, the document similarity statistics point to the existence of modules having very high similarity scores delivered across different years across different National Framework of Qualification (NFQ) levels of different programmes. These issues can be raised within the management structure of the School of Business and disseminated to the relevant programme boards for further consideration and action. Working within a climate of constrained resources with limited numbers of academic staff and lecture theatres the potential savings outside of the obvious quality assurance benefits illustrate a practical application of how text mining can be used to elicit new knowledge and provide business intelligence to support the quality assurance and decision making process within a higher educational environment.

Keywords: *web content mining, document similarity, text visualisation, network and link analysis.*

1. Introduction

One of the biggest challenges facing higher educational institutions is the exponential growth of educational data and the utilization of same to provide business intelligence to support the decision making process (Bala and Ojha, 2012). Educational data mining (EDM) is the application of data mining techniques to educational datasets and from this perspective the goal is not only to extract knowledge from data but also to use knowledge gained to improve the learning experience (Romero and Ventura, 2007; Romero and Ventura, 2010). Within the research field of EDM text mining has been employed for the purpose of analyzing the textual content of documents, forums, discussion boards and many others including web pages (Tane et al., 2004) the focus of this paper.

Web mining can generally be categorised into three areas (Zhang and Segall, 2008), web content mining, the aim of which is to extract knowledge from data contained within the content of web pages, web usage mining, the aim of which is to discover user access patterns from web usage logs and web link mining, the aim of which is to discover knowledge through the analysis of hyperlinks. The focus of this paper is on web content mining where an existing catalogue of module descriptors is extracted and then subsequently analysed using algorithmic techniques. Information in relation to programmes of study offered by the Higher Educational Institution under review is published in the public domain as per principles of the European Standards and Guidelines (ENQA, 2015) and available through <http://courses.itb.ie>. Module descriptors provide information on the educational aims/objectives, NFQ level and ECTS credits, module learning outcomes, the indicative content and assessment of modules, required reading, etc.

For the purpose of this analysis, the educational aims/objectives and the learning outcomes of modules within the School of Business are extracted and analysed using text mining techniques. The data mining objective is to acquire and extract the relevant information from the web page of each module, pre-process the data, perform document similarity analysis and export same for further analysis and text visualisation. The business objective is to quality assure module information as published within the public domain, identify degrees of commonality and overlap thereby identifying issues that may need to be addressed or provide further opportunity for the establishment of common modules that may be offered across the various disciplines within the school. Presently, programmes of study offered include General Business, Accounting and Finance, Sports Management, Business and Information Technology and International Business.

2. Data Aquisition

Rapidminer (Ritthoff et al., 2001) was employed for data acquisition, retrieving 231 web pages containing module information for modules delivered across the programmes within the School of Business. XPath was employed to extract the relevant information including the module code and title, aims/objectives and learning outcomes for each module. The bag of words approach was employed to model the extracted text. Generated tokens were transformed to lowercase and stop words were removed. The use of custom stopword lists that are domain specific, manually defined and that can be maintained by subject matter experts are considered good practice (Aggarwal et al., 2012) hence a custom stop word list was also applied to remove common words such as module, learner, student, completion, etc.

Examples of related approaches for modelling text document similarity include word based, keyword based and n-gram measures (Salton, 1989; Damashek, 1995). Having represented the extracted textual documents as term vectors the similarity between the documents was measured as the cosine of the angle between the vectors otherwise known as cosine similarity which was employed in generating document similarity statistics and is recognized as one of the most frequently used similarity measures employed for textual documents (Huang, 2008).

3. Document Similarity

Based on the document similarity statistics three issues of note became apparent. Firstly, modules although coded as being different and unique to their particular programme of study indicated substantial similarity. A total of 58 document pairings with a similarity score in excess of 89% point to the existence of common modules delivered across programmes within the School of Business. Examples include the Electronic Commerce modules delivered across the second year of the general business (BSST H2020) and the international business (INTB H2023) programmes returning a similarity score of 98% while the Supply Chain Management modules delivered across the fourth year of general business (BSST H4025) and accounting and finance programme (ACFN H4022) returned a similarity score of 99%.

The similarity of the Supply Chain Management modules are visually represented as word clouds in Figure 1. From a resourcing viewpoint one would expect that modules such as these with such a high similarity are recoded, retitled and offered as common within the same semester across the different programmes.

Secondly, there appears to be substantial content overlap with a lack of clear differentiation between sequential modules within each of the business programmes with 17 document

Thirdly and most concerning from a quality assurance perspective, the document similarity statistics point to the existence of modules having very high similarity scores delivered across different years, across different NFQ levels of different business programme disciplines. Examples of such programmes and modules are listed in Table 1.

Table 1. Modules with very high similarity scores delivered across different years, across different NFQ levels of different business programme disciplines.

Module 1	Module 2	Similarity
General Business - 4 th Year	Accounting & Finance - 3 rd Year	
BSST H4027 - Auditing	ACFN H3013 - Auditing 1	97%
Sports Management - 3 rd Year	International Business - 4 th Year	
SMCO H3016 - Selling and Sales Management	INTB H4030 - International Selling and Sales	96%

This third issue points to a possible failure in the quality assurance process in relation to module approval in that the learning outcomes of the modules in question do not accurately reflect the relevant award standard and NFQ level.

Module similarity as identified through similarity scores and visual techniques including word clouds can be further explored through network and link analysis and is discussed in the next section.

4. Link Analysis

In order to further analyse module similarity as provided by both the tabular output of scores and visualisation techniques discussed thus far, network and link analysis was employed using the interactive visualisation and exploration tool Gephi[♦]. While the document similarity statistics previously discussed provided the similarity between one module and another, Gephi was employed to identify the existence of multiple triangular relationships providing further evidence of the existence of previously undefined common modules being delivered within different programmes across the various disciplines within the School of Business.

[♦] <https://gephi.org/>

Examples include the Project Management module (Triangle B in Figure 3) delivered across the fourth year of the General Business (BSST H4014), International Business (INTB H4012) and the Business and Information Technology (BSIT H4013) programmes. The Introduction to Management and Cost Accounting module (Triangle A in Figure 3) delivered across the second year of the General Business (BSST H2022), Accounting & Finance (ACFN H2012) and the Business and Information Technology (BSIT H2017) programmes. Also, the Electronic Commerce module (Triangle C in Figure 3) delivered across the second year of the General Business (BSST H2020), International Business (INTB H2023) and the Sports Management and Coaching (SMCO H2016) programmes.

Visual representation of these examples of triangular relationships with similarity scores using Gephi is presented in Figure 3 on the following page. Expanding the data capture to include modules from other faculties/schools could possibly highlight further multidimensional relationships between programmes allowing further rationalisation and more efficient use of resources.

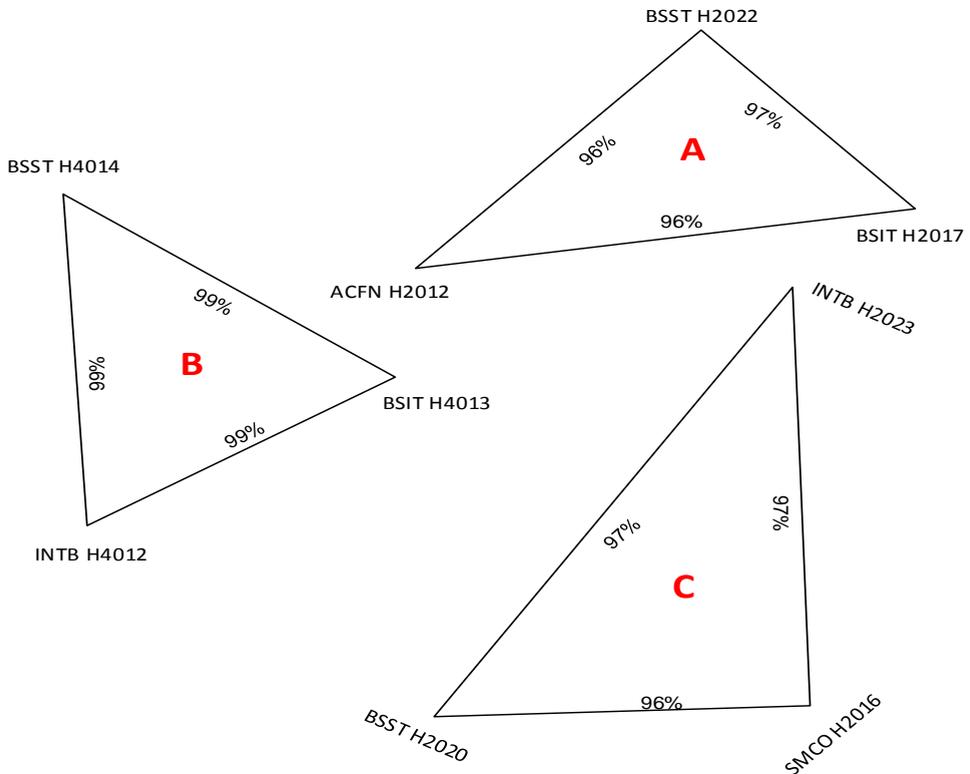


Figure 3: Triangular relationships with similarity scores using Gephi

5. Conclusion

Having gathered the necessary module data, extracted the relevant information and pre-processed the data, document similarity statistics were generated and further analysed through various visual exploration techniques. Resulting from this analysis, three issues of note became apparent. Firstly, modules although coded as being different and unique to their particular programme of study indicated substantial similarity. Based on this analysis 58 document pairings with a similarity score in excess of 89% point to the existence of common modules delivered across programmes within the School of Business. Secondly, substantial content overlap with a lack of clear differentiation between sequential modules was identified through this analysis with 17 document pairings having a similarity score in excess of 78%. Thirdly, the document similarity statistics point to the existence of modules having very high similarity scores delivered across different years across different NFQ levels of different programmes with 4 document pairings identified. These issues can now be raised within the management structure of the School of Business and disseminated to the relevant programme boards for further consideration and action. Working within a climate of constrained resources with limited numbers of academic staff and lecture theatres, the potential savings outside of the obvious quality assurance benefits illustrate a practical application of how text mining can be used to elicit new knowledge and provide business intelligence to support the quality assurance and decision making process within a higher educational environment.

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Is student procrastination related to controlling teacher behaviour?

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Abstract

Even motivated students procrastinate, because procrastination is triggered by a volitional (rather than by a motivational) problem. However, many factors, such as learning context, teacher interpersonal style, and also type of motivation may influence the occurrence of procrastination. The aim of the present study was to assess the relations between first-year university students' procrastination and controlling teacher behaviour. Four types of controlling teacher behaviour and three distinct measures of procrastination were evaluated and their correlations assessed. Findings revealed small but significant associations between (a) conditional use of rewards and decisional procrastination, and between (b) excessive personal control and task-avoiding procrastination. Results suggest that controlling teacher behaviour can negatively influence students' learning experiences. By using conditional rewards too often, teachers may defer their students' autonomous decision processes to engage in academic learning. And teachers trying to exercise excessive personal control may favour their students' perceptions of external regulation, limiting their possibilities of developing intrinsic motivation and autonomous self-regulated learning. Both resulting conditions could make it more likely for students to procrastinate academic learning, by engaging in alternative activities.

Keywords: *Student procrastination; decisional procrastination; controlling teacher behaviour; conditional use of reward.*

1. Introduction

Procrastination has been defined as repeated failure to perform actions necessary to reach one's goals (Lay, 1986) and as a voluntary delay in an intended action course, even knowing that this delay will probably have negative impacts one's own interests (Steel, 2007). All people procrastinate sometimes or punctually (and may not score high in procrastination questionnaires), but some do it regularly and in various situations, thus, being called procrastinators (Dewitte & Schouwenburg, 2002).

Education and academic success (starting as early as in primary school) is an important aspect of a person's upbringing that can have notorious effects on many components of their life success (Dewitte & Lens, 2000). But, it has been reported that, as much as around four out of five college students engage in procrastination, and that approximately 50% do it consistently, suffering at least some negative consequences (Steel, 2007). Some studies have even reported that one out of three students could be considered a severe general procrastinator (Day et al., 2000).

Students who procrastinate tend to underperform their non-procrastinating peers, even under circumstances of similar motivation and skill, suggesting that this lower performance may be explained by volitional causes, rather than motivational or skill-based causes (Dewitte & Lens, 2000). For example, procrastinators may lack the capacity of transforming their own intentions into action (Lay, 1986), sometimes because they are not able to construct an adequate mental representation of the targeted activity (Dewitte & Lens, 2000).

It has been argued that early development of motivation towards their studies can help children to overcome various difficulties arising in learning processes (Katz et al. 2011), but the relations between the promotion of specific motivational aspects and diverse types of academic procrastination have not been evaluated thoroughly enough (Katz, et al., 2014).

Systematic efforts to establish links between motivation, performance and wellbeing have come from Self-Determination Theory (Deci & Ryan, 2000), consistently arguing that context (family, school, teachers, peers, learning setting or socio-cultural contexts) may have multiple and important influences on motivation (Deci, 1971, 1975; Deci & Ryan, 2008). Specifically, SDT suggests that teachers can have two distinct interpersonal styles when approaching their students' learning processes: they can be either autonomy supportive or controlling (Ryan & Deci, 2000). Consequently, various studies have advocated for autonomy support as a guiding principle in pedagogy, because it has been found to enhance quality motivation, interest and successful learning, more than control does (Deci & Ryan, 1987). In this regard, much consideration has been given to autonomy support, but less attention has been oriented towards analysing the influence of controlling

behaviours, for example, on psychological experiences of athletes (Castillo et al. 2014) or students.

The present study aimed at contributing to fill in the research gap regarding the relations between various types of motivations (or motivation sources, such as controlling teacher behaviour) and student procrastination. Particularly, it was assessed if three distinct measures of student procrastination were associated with four aspects of controlling teacher behaviour.

2. Method

Participants of the present study were 108 first-year university students of the social sciences, 24 were males and 84 females, their ages ranged between 17 and 23 years-old ($M = 18.05$, $SD = 0.86$). During a regular class session, researchers presented students with questionnaires assessing procrastination and controlling teacher behaviours. Instrument of the present research was a self-report questionnaire, which included three procrastination scales, validated for Spanish adult population and reported by Díaz-Morales et al., (2006): the General Procrastination (GP) Scale (Lay, 1986), which is a one-dimensional 20-item measure that assesses a global tendency towards procrastinating across different situations and has been related to personality traits such as low self control or rebelliousness (Díaz-Morales et al., 2006); the 5-item Decisional Procrastination (DP) Questionnaire (Mann, 1982, as cited in Díaz-Morales et al., 2006), which evaluates the delay in making decisions that are bound to a specific time frame and in which high scores indicate a tendency towards laying off decision-making processes by doing other things; and the third procrastination scale used was the 15-item Adult Inventory of Procrastination (AIP), which has been related to a general tendency toward avoiding tasks, failing to meet deadlines or not getting things done (McCown & Johnson, 1989, as cited in Díaz-Morales et al., 2006). Lastly, the instrument included the Controlling Teacher Behaviours Scale (CTBS), derived by the authors from the Controlling Coach Behaviors Scale (Bartholomew et al., 2010, as cited in Castillo et al. 2014). This 15-item measure draws from an SDT-framework to evaluate coached athletes'/students' perceptions of their coaches'/teachers' controlling interpersonal styles, scored on four main aspects: (1) controlling use of rewards (CUR), which refers to the use of tangible and verbal rewards as an incentive for engaging with and completing a task or for reaching certain performance standards (Deci, Koestner, & Ryan, 1999, as cited in Castillo et al. 2014); (2) negative conditional regard (NCR), which refers to the withholding of love, attention, and affection by those in a position of authority when desired attributes or behaviours are not displayed by their subordinates (Assor, Roth, & Deci, 2004, as cited in Castillo et al. 2014); (3) intimidation (INT), which refers to the use of strategies to control behaviours in order to humiliate and belittle, such as verbal abuse

and threats, yelling, and the threat or use of physical punishment (Bartholomew et al., 2010, as cited in Castillo et al. 2014); and, lastly, (4) excessive personal control (EPC); which refers to the use of intrusive behaviours that attempt to interfere with aspects of the athletes' lives that are not directly associated with their sport participation (Bartholomew et al., 2010, as cited in Castillo et al. 2014). Independently of the fact that procrastination items were phrased in first person ("I do", "I am") and controlling teacher behaviour items in third person ("my teachers do", "I have teachers that are"), participants had to rate all items on a 5-point Likert scale, ranging from 1 = "not at all like me" to 5 = "very much like me".

The intention was to describe students' perceptions of controlling teacher behaviour (on four different aspects) and assess if these were related to three distinct measures of student procrastination, utilising correlation analyses performed by means of SPSS 23 statistical analysis software package.

3. Findings

As Table 1 shows, procrastination among participants received moderate scores, around and below the neutral 3-point mark (3 = "sometimes like me, other times not"), suggesting sporadic procrastination. It is noteworthy that general procrastination (GP) received the highest score of the three procrastination scales, but at the same time, with the lowest standard deviation, suggesting that it is regular, among first-year university students, to procrastinate sporadically, when it comes to general situations. Decisional Procrastination (DP) and the measure linked to task avoidance (Adult Inventory of Procrastination - AIP) also received moderate scores, however, their standard deviations were bigger, suggesting that students reported more intersubject variations on these two procrastination scales.

Regarding correlational aspects, general procrastination (GP) was not associated with any of the four measures of controlling teacher behaviour, indicating that this type of procrastination is prevalent among first-year university students, but independent of their teachers' controlling (or alternatively, of their teachers' autonomy-supportive) behaviour.

Furthermore, findings revealed significant associations between (a) conditional use of rewards (CUR) and procrastination (DP); and between (b) excessive personal control (EPC) and high scores on the Adult Inventory of Procrastination (AIP) related to task avoidance, indicating that teaching style was associated with procrastination linked to autonomously deciding to study/learn; and procrastination linked to avoiding getting tasks done.

Table 1. Descriptives and correlations between three procrastination scales and four controlling teacher behaviours among ($N = 108$) first-year university students.

	<i>M</i>	<i>SD</i>	GP	DP	AIP	CUR	NCR	INT
GP	2,70	0,49						
DP	2,49	0,85	.42**					
AIP	2,35	0,67	.70**	.32**				
CUR	1,65	0,57	.11	.22*	.13			
NCR	1,89	0,64	.08	.07	.12	.36**		
INT	1,30	0,34	.06	.09	.11	.34**	.41**	
EPC	1,44	0,46	.13	-.03	.19*	.33**	.32**	.18

Note. $N = 108$. * $p < .05$; ** $p < .01$. General Procrastination (GP); Decisional Procrastination (DP); Adult Inventory of Procrastination (AIP); Conditional Use of Rewards (CUR); Negative Conditional Regard (NCR); Use of Intimidation (INT); Excessive Personal Control (EPC).

4. Concluding Remarks

Academic success is an important part of life success (Dewitte & Lens, 2000), but procrastination can affect it negatively and is very prevalent among students (Steel, 2007). In this respect, it is clear that motivation can help a person overcome difficulties that arise in any practice, but it is rather unclear in which ways the facilitation of diverse types of study motivation can influence a person's procrastination (Katz, et al., 2014)

Results point in the direction that controlling teacher behaviour might negatively influence students' psychological experiences in learning. Teachers who constantly use conditional rewards may interfere with their students' autonomous decision processes regarding studying. It is possible that this interference may stem from the fact that this kind of teacher behaviour may draw attention to specific tasks (considered important by the teacher), but may at the same time overlook volitional aspects, critical for ongoing engagement and maintenance of high autonomous motivation and self-regulation in learning. With high probability it would be more useful for teachers to give their students recognition when they autonomously study or learn, in this way modelling their autonomous motivation and self-regulation, by drawing attention to (and encouraging), not only the successful completion of a task, but more importantly the personal disposition that lead the students to get autonomously motivated to learn in a self-regulated manner.

Furthermore, excessive personal control may favour students' perceptions of external regulations, decreasing intrinsic motivation and autonomous self-regulated learning, thus, making it more likely for them to engage in alternative activities, procrastinating important academic learning. Teachers may benefit from observing the positive effects of autonomous self-regulated learning on their students' motivation and performance. Taking these positive effects into consideration, teachers should find it easier to refrain from trying to exercise excessive personal control, knowing that controlling teacher behaviour tends to negatively affect both student motivation and performance, whereas autonomy-supportive teacher behaviour tends to foster autonomous motivation and self-regulated learning.

Both, the negative effect of conditional use of rewards on students' decisions to study, and the negative effect of excessive personal control on students' academic task completion, signal that teachers' interpersonal teaching styles can interfere with critical volitional processes in which students have to conduct themselves through their learning experiences on their own.

Nowadays, students have access to virtually every piece of information there is; however, the autonomy with which they use new technologies to access, gather and organize information and knowledge should not be put in jeopardy by their teachers' interpersonal styles: if teachers realise that their students will have more chances of developing autonomous motivation and self-regulated learning insofar they foster their interests and their self-perceptions as curious students who autonomously search for new knowledge, they will be putting them in the best of conditions to cope with the standards of society in the information era. Teachers who do not refrain from controlling behaviours may trigger student experiences, which do not lead to better motivation or performance, but rather to interpreting teachers' inputs as external regulations, thus, reacting by focusing their attention on alternative activities, procrastinating academic learning.

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Automated Program Analysis for Novice Programmers

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Abstract

This paper describes how to adapt a static code analyzer to help novice programmers. Current analyzers have been built to give feedback to experienced programmers who build new applications or systems. The type of feedback and the type of analysis of these tools focusses on mistakes that are relevant within that context, and help with debugging the system. When teaching novice programmers this type of advice is often not particularly useful. It would be instead more useful to use these techniques to find problem in the understanding of students of important programming concepts.

This paper first explores in what respect static analyzers support the learning and teaching of programming can be implemented based on existing static analysis technology. It presents an extension to static analyzer PMD was made so that feedback messages appear which are easier to understand for novice programmers. To answer the question if these techniques are able to find conceptual mistakes that are characteristic for novice programmers make, we ran it over a number of student projects, and compared these results with publicly available mature software projects.

Keywords: *Programing education, tool support, static analysis.*

1. Introduction

Professional software development teams are using a range of tools to detect and correct mistakes in their programs. It is common to distinguish between dynamic and static analysis tools. Dynamic code analyzers look at code while it is executing, often by running a given set of tests, or test that have been generated. Static code analyzers check for programming errors in code by automated inspection of the code. This includes simple errors, like violations of programming style, or uninitialized variables to, serious errors and often difficult to detect error, such as memory leaks, race conditions, or security vulnerabilities.

This paper describes how to adapt an off-the-shelf static code analysis tools to support teaching of novice students. This requires first an analysis to what extend the different context in which it is used changes the requirements for the tool. Static analysis tools such as Coverity and FindBugs are meant for experienced developers, who know how to program. They do not look for errors that experienced programmers rarely if ever make, and focus instead on errors that even experienced programmers find difficult to debug for (Bessey, et al., 2010) (Hovemeyer & Pugh, 2004).

Another crucial difference is that the tools for development teams are built to aid with debugging a software system. An error that is found statically in the code may produce a run-time error in de production code, and the tools help with correcting those. In a learning context errors usually point to lack of understanding of important an concept, from basic concepts, such as the difference between a variable and a value, to more advanced concepts such as encapsulation. The foremost aim is not to correct the program, but to help students and teachers to identify misunderstood concepts, such that these can be addressed.

Other consequences arise from changing the context in which the tool is used. Reported errors may relate to the concepts which the students does not know, and a student students may get stuck trying to address a warning that is not understood. In the process they often introduce further errors that make the warning go away, but only since the changes obfuscated the initial error. The tool should recognize that these are not the problem itself.

Finally, there is also the fact that software development team like to see coding guidelines enforced that make sense in that context, for example compliance with industry standards, or making their code analyzable for other tools, or ensuring consistency among different platforms. For student these warning can often be overwhelming, confusing, or a nuisance.

This paper discusses how to adapt PMD¹ with custom rule to suit the needs of novice programmers in JAVA. The benefits of using an off-the-shelf tool is that we have access to

¹ Available at <https://pmd.github.io/>

the underlying analysis technology that has been proven its use in practice. It also means that the tool can be readily used in an Integrated Development Environment, or even an automated build system. The extension of PMD aims at both students and their teachers. Students immediately see what they did wrong, while it helps the teacher to speed up the process of looking through assignments and give meaningful feedback. It would also standardize to some extent the issues different markers look for.

Dynamic tools have been incorporated in numerous teaching environments, most prominently in BOSS (Joy, Griffiths, & Russell, 2005). FrenchPress uses static analysis to provide feedback to students, however is intentionally not built on an existing tool such as PMD (Blau, Eliot, & Moss, 2015). It implements a number of tests similar to those presented in this paper, but does not use the full range that static analysis tools offer. Sen reviews the usage of code analysis in programming class (Sen, 2014), and mentions that custom rules can help in the classroom, however does not explore the rules themselves. Machine learning techniques are used in (Srikant & Aggarwal, 2014) to analyze student code, but the focus lies on automated grading instead of giving feedback that relates error to misunderstood concepts.

The next section will discuss the challenges of static analysis for novice programmers, and the type of behavior we might observe. Section 3 will discuss custom rules, and Section 4 an experimental evaluation, that compares student projects with publicly available software projects, that were presumably developed by experts. These results confirm that those rules are effective in detecting error made by novices.

2. Challenges for Static Code Analysis for Novice Programmers

Figure 1 depicts an example of code that is typical of student code. It points to a student

```

char  reply;
char  Y;

do{
    System.out.println("Do        you        want        to
    continue?");
    reply = (char) System.in.read();
                } while(reply != Y);
                ^
Variable `Y' might not have been initialized

```

Figure 1: Typical static analysis tool feedback

who fails to understand the difference between character variables and character literals. The loop is meant to check if the reply is the character 'Y', but instead the student compares it to the (undefined variable) Y. The program would initially not compile, and the compiler would issue an error message about an undefined variable Y. Many novice programmers would address this error by introducing a variable `char Y`. This results in the code in Figure 1.

Some compilers, and most static analyzers, would warn that variable Y has not been initialized. Many students would then try to address this warning, and initialize the variable, such as `char y = 0;` or `char y = '0';`, even though this does nothing to address the actual error. This will remove the error warning, but only conceal the bigger problem, namely that the student confuses the literal 'Y' with a variable 'Y'. In contrast, when an experienced programmer gets the first warning about variable 'Y' being undefined, they will immediately realize that they simply forgot the quotes around the Y.

Another example is the following one-liner:

```
if(string1 != null || string1.equals(string2)){...}
```

The current feedback of PMD will state that the variable 'string1' will always be null at the second occurrence of 'string1' in this line. To understand the message the student has to understand the evaluation order of short circuit operators `||` and `&&`. The right hand side of the operator `||` will only be evaluated, if the left hand side evaluates to false. The left hand side in this example is only false if `string1 != null` is false, thus if the string is null. Hence, the warning that `string1` will always be null when `string1.equals(string2)` is evaluated. The actual problem has nothing to do with the evaluation order of short circuit operators. The student simply mixed up `||` and `&&`, a very common mistake by novice programmers. The feedback should ask the student if he accidentally mixed up the operators, and intended to use `&&`.

A list of 20 errors, which are often made by beginning programmers was created and discussed by Hristova (Hristova, 2003). We use this list to address the following questions: Which of these error can static analysis tools find? What kind of information has to be relayed to a novice programmer to know what they did wrong? Can this be related to concepts that the students may misunderstand? How effective are the added and modified rules in finding issues that are characteristic of novice code?

As mentioned before, PMD has been chosen as the tool to extend. However, this is far from the only tool available for Java code analysis. The three most popular tools for Java are FindBugs, PMD and Checkstyle. Checkstyle is mostly concerned about correcting certain code styles. FindBugs is a tool that looks at the java byte code. This is very useful for detecting serious coding errors, it limits its use to define the appropriate rules at the level of

the uncompiled syntax. PMD is a good hybrid between the two previous tools. It utilizes a generated abstract syntax tree (AST) from the source code, and then uses code patterns to identify bad practices. All tools have in common that code that cannot be parsed can also not be checked by tools.

- A. Confusing the assignment operator (=) with the comparison operator (==).
- B. Use of == instead of .equals to compare strings.
- C. Unbalanced parentheses, curly brackets, square brackets and quotation marks, or using these different symbols interchangeably.
- D. Confusing short-circuit evaluators (&& and ||) with conventional logical operators (& and |).
- E. Incorrect use of semi-colon after an if, while or for statement.
- F. Wrong separators in for loops (using commas instead of semi-colons).
- G. Inserting the condition of an if statement within curly brackets instead of parentheses.
- H. Using keywords as method names or variable names.
- I. Invoking methods with wrong arguments (e.g. wrong types).
- J. Forgetting parentheses after a method call.
- K. Incorrect semicolon at the end of a method header.
- L. Getting greater than or equal/less than or equal wrong, i.e. using >= instead of >.
- M. Trying to invoke a non-static method as if it was static.
- N. A method that has a non-void return type is called and its return value ignored/discarded.
- O. Control flow can reach end of non-void method without returning.
- P. Including the types of parameters when invoking a method.
- Q. Incompatible types between method return and type of variable that the value is assigned to.
- R. Class claims to implement an interface, but does not implement all the required methods.
- S. Confusing character variables as literals
- T. Null check followed by ||
- U. Many if/else checks on the same variable.
- V. Instance variable not being used globally within the class. i.e., an instance variable can be reduced to a local variable.
- W. Switch statement does not contain a break.
- X. Switch statement without default case.
- Y. Out of array bounds by using <= instead of <.

Figure 2: Hristova's rules for novice programmers

3. Rules for Novice Programmers

A list of 20 errors that are often made by beginning programmers was created and discussed by (Hristova, 2003). These have been gathered by talking to experts and noting what they have experienced while teaching students how to program.

We classified these rules into four categories, with respect to PMD:

1. Errors that cause the program to be unparsable, and thus not fit for static analysis.
2. Errors currently not found by PMD.
3. Errors found by PMD but with feedback not suitable for novice programmers.
4. Errors found by PMD with suitable feedback for novice programmers.

Given the list of rules in Figure 2 we found that rules C, F, G, H, and L yield unparsable code, errors A, D, J, N, S, T, U, V and Y are not found, B, E, W, and X are found but with unsuitable feedback, and errors I, K, M, O, P, Q, and R are found with suitable feedback. PMD has an option to implement custom made rules and rulesets. A ruleset “Novice” was created with custom rules to cover errors that are missing or have unsuitable feedback.

The warning created by the new rules consists of the following elements: First, the warning specifies what part of the code generates the error. This typically consists of a line number or, in Eclipse, a small arrow in the side column to indicate there is something wrong on this line and an explanation of the error.

Second is a suggestion on how to fix the error. This could be one suggestion, or multiple. For example, if an instance variable is only used in one method, one suggestion could be to make that variable local to that one method. However, another suggestion could be to make the variable ‘final’, to indicate it being a constant.

Last is a reference to information on the concept that is presumably poorly understood. If possible we tried to refer the errors back to the textbook “Programming and object oriented design using Java” by Nino and Hosch [5], as book is used in our main first year programming course. This was included if applicable.

We encountered a few challenges when extending PMD, mainly around creating rules that look at multiple classes or projects as a whole. In PMD, there is no method which is called after the entire class is analyzed using a certain rule. This makes it more complicated to add rules that build on information collected from the entire class. Similarly, it is difficult to use information from other classes, if that class has not yet been analyzed by PMD. The order in which classes are analyzed matter. For these reasons, we implemented only new rules for seven of the nine errors that were not sufficiently covered by PMD.

4. Experimental Results

To evaluate the effectiveness of the new rule set in finding mistakes made by novice programmers, we analyzed code by novice and professional software projects. The novice projects are assignments and final projects from a first year programming course at our university. When students created these projects, they were near completion of the course. The professional code was taken from six parts of the ‘*org.apache.commons.codec*’ library:

.codec itself, *.binary*, *.digest*, *.language*, *language.bm* and *.net*. The results of this comparison are depicted in Table 1.

	Projects	Total Size in LoC	Standard warnings	Standard Warnings per 1kLoC	Novice warnings	Novice Warnings per 1 kLoC	Projects w/o novice warning
Novice code	24	89056	59462	667.7	592	6.6	0
Expert code	6	6485	3679	567.3	16	2.5	4

Table 1: Comparison of two code bases given the two sets of rules

Rule	Description	Number of Warnings	Percentage of warnings
V	Instance variable not being used globally	464	78.4%
W	Switch statement does not contain a break.	34	5.7%
U	Many if/else checks on the same variable.	33	5.6%

Table 2: Top 3 of warning in novice code

The results show that the new set of rules for novice programmers are effective in catching typical novice mistakes. Novice code has only a slightly increased number of warnings when we consider the standard set of rules used by PMD, an increase of about 17%. When we look in comparison at the warning by the novice set of rules we see an increase of 164% more warning in novice code.

The new rules are effective in finding mistakes that are indicative of novice programmers. This finding is also supported by the fact only two of the six professional project have any novice warning, while all 24 student projects have at least some potential mistakes. This confirms the observation that this are problems that experienced programmers rarely make.

If we look at the Top 3 of errors made by novice programmer in Table 2, we see that the most common errors relate to the structure of code. Apparently, novice programmers struggle with deciding the appropriate scope of variable, and the correct use of control structures.

5. CONCLUSIONS AND FUTURE WORK

This paper describes how to adapt the off-the-shelf static code analysis tool PMD to support teaching programming to novice students. It discussed how the fact that these tools were developed for a different purpose - namely to support software development - make them less than ideal. We identified the need to provide a different type of feedback to students; one that identifies misunderstood concepts, instead of errors that need to be fixed. We used a list of 20 common novice mistakes by Hristova (Hristova, 2003) to guide the development of a new set of rules for PMD. We compared its effectiveness in finding errors in novice code, by comparing the results for a novice student projects, with mature software projects.

The student project were by students at the end of an intensive programming course. This means that the code is fairly mature for student code. Future work will be to see how the tool can effectively be incorporated throughout the course, and how it can help teaching assistants who play an important role in helping student to avoid such mistakes. We will also investigate how to broaden the scope of the analysis to better cover concepts that novice students often misunderstand.

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Animal welfare and Ethics course for post-graduate at Veterinary School: how to improve assessment methodologies with a bottom-up approach.

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Abstract

Animal Welfare, with its strong ethical component, is increasingly central to public debate and in all sectors dealing with animals has become a key expertise to acquire. This paper presents a post-graduate level course on animal welfare and ethics assessment delivered by the Veterinary School of Padua University, Italy. The course was delivered at Garda Zoological Park, Italy, allowing students to do an experience with wildlife in a peculiar management system. Teachers used an inquiry-based approach to lead students 'construct' their experience in welfare assessment. At the end of the course students, divided into groups, had to develop a protocol for the assessment of the animal welfare of a species in the zoo. The analysis of these final works and a pre-test and post-test questionnaires were used to assess the effectiveness of the course. Results highlighted a growing awareness of the complexity of assessment methodologies and more attention on animal based indicators. Students found difficulties using a bottom-up approach but were satisfied at the end of the course. Improvements can be done to promote reflections on reasons to assess animal welfare and its ethical component, on the utility of such assessment and on a balanced use of tools and methodologies.

Keywords: *Animal welfare, ethics, assessment, inquiry-based learning, bottom-up approach, zoo animals.*

1. Introduction

Nowadays teaching animal welfare in its scientific and ethical intertwining facets to all professionals dealing with animals in human care is of paramount importance. Media, common people, and professionals dealing with animals in every field join a debate about animal welfare that is becoming more widespread and complex every year. Members of the European Parliament receive more pressure about animal welfare than about any other topic (Broom, 2005). Many sectors are involved, from scientific research and farming to companion animals and wildlife conservation and many professions like physicians, biologists, veterinarians, keepers, and animal scientists deal on a daily basis with animal welfare issues.

Traditionally, training in Animal Welfare was primarily within the limited scope of animal health and productivity, and the curriculum has reflected this limited understanding for a long time (De Boo & Knight, 2005). Today, the range of animal subjects considered in animal welfare courses has been extending and there is a strong need to improve training of people in assessment methodologies and in the ethical evaluation.

This paper is focused on a pilot course about animal welfare and ethics assessment methodology. Authors chose to start the experience with a post graduate course because this kind of training allowed more flexibility in a subject that deserves new developments: the objective was to test the learning methodology and to spread understanding of the theoretical and practical difficulties related to welfare assessment. Furthermore, that type of course allowed participants to cross over the experience on welfare issues that they encountered in their work experience in different fields: people working with farm animals were able to confront issues and methodology with people working in zoos or with companion animals.

To test the knowledge on welfare assessment and ethics, authors developed a questionnaire of 20 questions. The questionnaire allowed to identify modification in the way of thinking of the students about animal welfare and ethics after the course and the practical experience offered in it. Interestingly, authors observed that even professionals that deal with animal welfare issues daily could have never thought over what welfare is. Common prejudices as that welfare is only the absence of suffering, or that if animals are healthy or they can adapt to a certain situation it means their welfare is acceptable, are still surprisingly common.

2. Course details

The course “Animal Welfare and Ethics” was organized by the Department of Comparative Biomedicine and Food Science of Padua University. The course was a lifelong learning training open to veterinary medicine, life science, animal science and human science degrees. It was a 48-hour course, held during three weekends (one in September, one in October and one in December), organized in twelve 4-hour sessions, two of which were held on Fridays and two on Saturdays. The course was distributed over such a long time period to let students have the time to work on the project-work they were assigned at the beginning of the course and to allow them to follow up on the concepts learned with a bottom-up methodology. No specific competencies on animal welfare science were requested to the students. The teachers belonged to different scientific areas to encompass the interdisciplinary of the topic, such as veterinary sciences, behavior science, biology and ethics and all of them had specific competencies in animal welfare.

The lessons were mostly given at Garda Zoological Park (Bussolengo, Italy). This zoological garden has already been a partner of Padua University in several training projects in the past years. It belongs to important zoological networks, such as WAZA (World Association of Zoos and Aquariums), and the researchers of this institution are carrying out several projects on animal welfare. The setting of the course gave students the opportunity to do practical experiences and to test the tools learned during the course directly on the animals managed in the zoo. Groups were organized to include people from different backgrounds in order to promote cross-pollination of expertise and points of view, for example, a more ecology-oriented perspective from biologists, and a more health-oriented one from veterinarians. Zoo animal species were chosen as a topic, because welfare assessment in these species poses several additional methodological problems, such as the scarcity of scientifically published work on the welfare of these species and because there is an urgent need to develop assessment skills in this field.

As a final test, students were requested to do a project work in groups: the assignment was to design a scientifically grounded and feasible protocol to monitor welfare in a species to be applied as an internal control in a zoological park. The aim was to make the students aware of the difficulties and complexity of designing a welfare assessment protocol, which is scientifically validated.

Each group had to devote its attention to one species in a single exhibit. They received a template and bibliography on the species maintained in the enclosures and were requested to include in the protocol, freely, the different tools presented during the course. As a final assessment, each group had to present their project work to a commission of experts. The commission was composed of the teachers, the scientific Director and researchers of Garda

Zoological Park, the scientific Director of Genoa Aquarium, and by academic representatives for international projects of Padua University.

Beyond classes, practical activities and group projects, students had the choice to join a workshop in South Africa. That experience was optional but complementary to the syllabus of the course. The workshop in South Africa was held by a local conservation organization (Conservation Guardians) in partnership with Padua University. The aim of the workshop was to introduce the students to an international frame of what is welfare in conservation activities and to highlight the importance of remaining open-minded about different cultures and different methodologies.

2.1. Contents of the course

The students were initially prompted to reflect critically on the general meaning of animal welfare (and its link with ethics) and on what the different parameters, traditionally found in the scientific literature to measure welfare, actually meant. Issues such as reliability, validity, standardization, and validation of the parameters, especially of behavioral ones, were discussed. Different parameters were described and their suitability and limitations in accordance with recent definitions of Welfare were discussed. Attention was focused on the importance of giving priority to animal based parameters as they were likely to be more representative of the perception an animal has of its own situation. Also, the need to assess multiple parameters and to use multiple methods in order to overcome the shortcomings of each was highlighted.

A brief outline of the quantitative and qualitative methods of behavior analysis was given. The pros and cons of the different sampling and recording rules were briefly discussed. The concept of working ethogram was introduced as was the importance of tailoring the working ethogram, the sampling and recording rules and the experimental design to the hypotheses to be tested. Hereafter, the students were asked to practice the two methods in conjunction with the others already exposed directly in front of the enclosures of the zoo. Simultaneously, students were confronted on ethical evaluation methodologies, using ethical matrices and decision making processes, and forced to do their experience in groups. Then they were asked to include the ethical tools in the designing of protocols for the project work.

2.2. Educational methodologies

Since the aim of the course was to introduce the use of different tools for animal welfare assessment and ethical evaluation, lecturers, who were also the ones who had designed the course, wanted to improve more practical skills than theoretical competencies. Moreover, considering the need to prompt a new way of thinking about animal welfare issues, lecturers decided to encourage critical thinking that many studies reported as a good strategy to promote transfer to novel domains of knowledge (De Boo & Knight, 2005; Halpern, 1998; Kosonen & Winne, 1995). They decided to promote critical thinking through the use of both direct and inquiry-based learning approach, considering the benefits of adopting more than one learning approach (Ku, et al., 2014). In every session, after a brief theoretical introduction, students were asked to use the methodology or the tools just introduced. For example, to introduce the use of welfare checklists, students listened to a short introduction and then visited a dairy farm and tried to complete an already developed checklist assessing cow welfare. During these experiences, students had the opportunity to share their different expertise: some of them, for example, had never visited a dairy farm before, while others were ordinarily working with those animals. The bottom-up approach was not always easily accepted by students, who were mainly familiar with traditional direct top-down learning approach. Students were pushed out of their *comfort zone*: sometimes during the activities, they communicated discomfort, but after completing the experience they were all satisfied.

The same approach was used also for ethical lessons where difficulties increase for the lack of familiarity with decision making analysis and discussion. After introducing the tools and concepts, a case study was submitted and the students, divided into groups, had to discuss the case. At the end of the session, each group had to discuss with the others. During these activities, the lecturers served as facilitators to encourage thought-exchange and to challenge participants to re-evaluate their reasoning (Ku et al., 2014).

Groups for the project-work were formed by the lecturers, carefully mixing different competencies and work experiences, considering that diversity in group composition could improve group learning (Curşeu & Pluut, 2013). Self-manage learning groups are commonly used in higher education. In this course team working was used to recreate a real life situation in which animal welfare should be assessed by a team of different professionals and because of the positive outcomes that working in a group can promote (Lizzio & Wilson, 2006).

3. Results

The course had a good response: 21 final students selected: 16 females and 5 males. The range of age was from 25 to 60 years, 19 of them had a degree and 2 of them had a school leaving certificate (awarded after five years of high-school). Among the 19 graduates, 12 students had a degree in veterinary sciences, 5 had different animal science degrees, 1 had two degrees in philosophy and psychology and 1 had a degree in mathematics.

A questionnaire was created for this pilot course and the results were analyzed using descriptive statistic. To investigate the influence of the course, the questionnaire includes an open question about the definition of animal welfare. In Figure 1 there is a summary of the concepts used by the students in the pre-test and post-test answers.

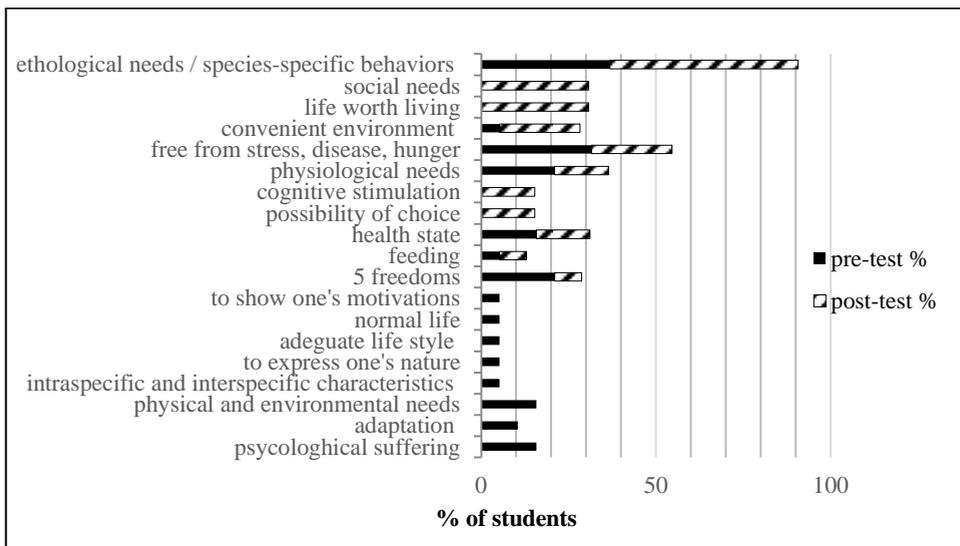


Figure 1. Concepts used by students to give a definition of "Animal Welfare" in pre-test and post-test.

Some concepts are present in both tests as "ethological needs/species-specific behaviors", "freedom from stress, disease and hunger", "health state" revealing that students had a previous idea of what welfare is. Some other concepts are used only in the post-test as "social needs", "life worth living", "cognitive stimulation", "possibility of choice". These concepts are more connected with a view that recognizes the mental complexity of animals and the need to include ethical evaluation and positive aspects into the assessment process. The pre-test vs post-test answer comparison shows a change of point of view or at least a deeper reflection on the topic.

Figure 2 shows answers given in pre-test and post-test to questions asking to enumerate 3 priority issues to be checked to assess animal welfare in a cattle shed. This graph highlights that some issues were listed both in the pre-test and post-test answers, even if with difference frequencies, such as checking “facilities and environment”, and “behavioural individual issues” or “health and general sanitary checks”. The need to monitor “presence and quality of the food” that was included in the list by almost 60% of the students in the pre-test dropped to less than 20% in the post-test. This means that controls on “food” after the course were not considered as important as before, maybe because, with a deeper knowledge of the complexity of welfare assessment, students realized that this issue is not enough to guarantee a good level of welfare. Interestingly, monitoring for the “use of space” and “access to food and nutritional status” highlighted that the students paid more attention to animal based indicators and the fact that more than 20% of students indicated in their post-test list monitoring for “behavioural social issues” confirmed, as in figure 1, a deeper awareness of the mental complexity in animals.

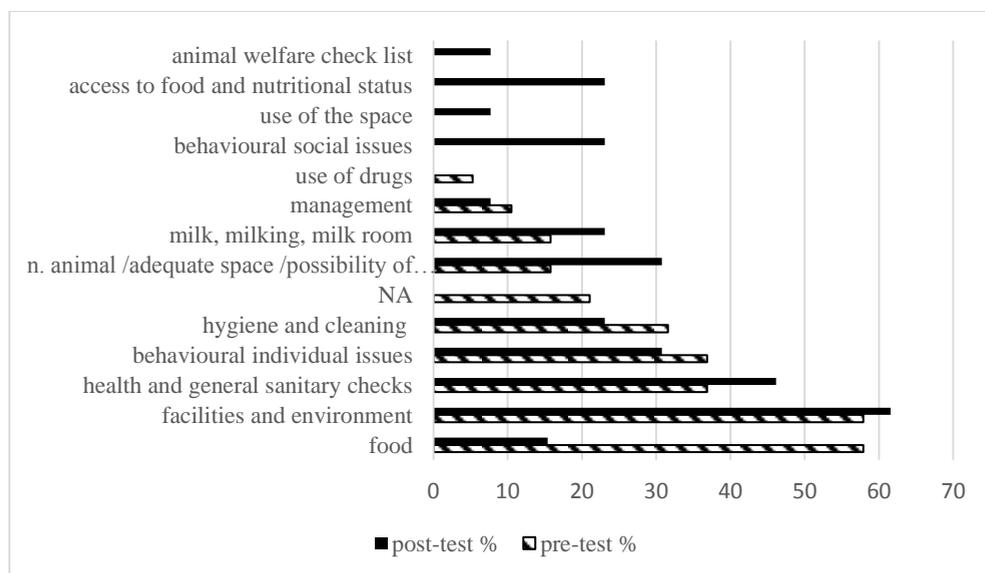


Figure 2. Percentage of students that have chosen priority checks to assess animal welfare in a cattleshed in pre-test and post-test.

Project works were introduced for the final assessment of the learning contents and methodology and for evaluating the effectiveness of the course and the ability of participants to work in teams. Examiners evaluated if students understood which tools were more suitable to be used in different contexts and how to use them in a coherent assessment. The final discussion also allowed the lecturers to assess the effectiveness of the

course itself. The discussion of the project works outlined that all groups recognized the importance of assessing different parameters and of including different methods with several time schedules for welfare assessment. All groups included checklists and quantitative behavioral assessment and gave priority to animal based indicators, integrated by some management and environmental indicators, when measuring direct animal outputs was not feasible. All groups made an attempt to quantify the costs in terms of time and human resources of the assessment protocol and focused on the importance of a better training of the staff involved in animal welfare assessment. Only some of them introduced the ethical tools, probably because of the difficulties in changing their mind and perspective on the role of ethics in this field and to their lack of familiarity with ethical evaluation methodologies. Students reported a range of difficulties in the construction and application of the Welfare Protocol, but they realized this is a realistic condition in which a team that works on animal welfare assessment could be asked to work in, so in the end, they were happy to have the opportunity to do this experience.

4. Conclusion

Authors detected a strong student interest in animal welfare assessment and ethical evaluation subject. Lecturers realized that students benefited not only from the range of lecturers and activities but also from interaction within the group because of the different work experience and background studies. Students said they had the opportunity to change some attitudes and approaches to everyday management of animals and their welfare. Methodologies and contents chosen by authors were proved to be adequate to achieve the aims of the course, even if improvements can be done especially to promote: 1) glossary learning, 2) reflections on reasons to assess animal welfare and the utility of such assessment in routine animal management, 3) a more balanced use of different tools and methodologies.

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Competency Based Education – Current Global Practices

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Abstract

Competency Based Education (CBE) is considered an alternative to face the lack of individuals with the appropriate labour abilities. A state of the art on CBE in terms of the practices being performed by main worldwide universities/colleges is presented. Main promoted competencies include effective communication, critical thinking and lifelong learning. Also, teaching and practice activities are determined such as real life situations and simulations. Regarding competency assessment techniques, a mix of them is used to guarantee the desired competency level. Achievements of competencies are reported with a pass or not pass grade and with narrative transcripts. CBE benefits from student's perspective are also determined.

The main advantage of CBE is that measures what a student can do after completing a program. It is also flexible, as universities/colleges of any size/age can incorporate it at different levels, which depends on their resources and strategies. Even though CBE has proven to solve a global problem, the gap between the supply and demand of skillful people can only be reduced if all the concerned parties work together in a coordinated manner.

Keywords: *CBE, Competency Teaching and Assessment Techniques*

1. Introduction

Competency Based Education (CBE) is considered an alternative to face the lack of individuals with the appropriate labour abilities (Dawson, Dean, Johnson, & Koronkiewicz, 2014). It is defined as a “knowledge based methodology which concentrates on measuring what a person can actually do as a result of learning” (Umbleja, Kukk, & Jaanus, 2013, p.552). CBE importance lies in the fact that it contributes to prepare people to add value to organizations and also to adapt to the global economic demands.

As we reviewed the foundations of CBE (Hernández & Morales, 2016), strategic knowledge was integrated such as the fundamentals of competency concept, the competencies students of different levels and areas must acquire to succeed and the occupational trends with related skill demands. A state of the art on CBE in terms of the practices of main universities and colleges worldwide will be presented. Papers, reports and official sites of CBE organizations were analyzed to determine their characteristics. Also, discussions around this project based on several years of consulting, researching and teaching activities were performed. The outline of the paper is as follows: in Section 2, the different levels of CBE implementation are explained. Section 3 presents an analysis of the CBE models of main universities/colleges worldwide. Section 4 describes what is going on in CBE. Section 5 concludes the paper.

2. CBE Classification Centered on Implementation Levels

Universities and colleges that have already adopted a CBE approach exhibit different levels of implementation based on their strategy. It can be seen like a continuum, Fig. 1.

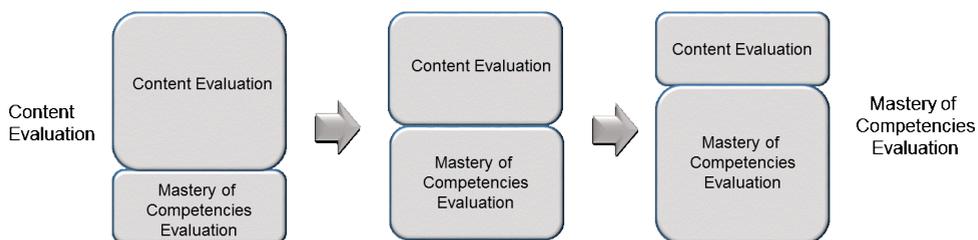


Figure 1. CBE content versus mastery of competencies evaluation continuum. Source: own elaboration.

In the left level, organizations place great importance to the acquisition of knowledge and the courses are in the traditional format. However, the curriculum is organized around competencies. In the center level, there is a relative equilibrium between knowledge and competency evaluation. It is like a hybrid approach where students attend courses to learn content and, on average, 50% of the class assessment is direct, i.e. earn credits based on the

mastery of competencies. Finally, in the right level, students do not attend traditional courses and the evaluation is 100% of competencies (CRACUS, 2015; Tracy, 2016).

3. CBE Model Analysis of Main Universities and Colleges Worldwide

An analysis of the *CBE* models of main universities and colleges worldwide categorized on the levels previously described is presented below. The organizations were selected based on their mention in previous researches on the subject. Also, the level of *CBE* implementation was analyzed to exhibit the most representative ones. Finally, consultations with experts of our institution were performed to determine the accuracy of the choice.

3.1. Low Level CBE (80% Content Evaluation / 20% Mastery of Competency)

Delaware County Community College (United States). This college has taken the basic approach of *CBE*. It has identified 10 general competencies to develop: Proficiency in mathematics, reading, writing and speech communication, Concept of self, Apply the meaning of career, Lifelong learning, Decision-making, Arts and humanities, Social, political, business and economic systems, Science and technology, Critical thinking and technology skills and Diversity. Techniques for teaching them include: internships and paid work (DCCC, n.d.). The competencies are incorporated in the curriculum and there are no specific methods of assessment. Teachers are not required to document them (Klein, 2012).

Lingnan University (China). This university is new at incorporating *CBE* (Lui & Shum, 2012). The general competencies that undergraduate students must acquire are 7: Independent and critical thinking, Creativity and innovation, Communication, Social responsibility, Personal virtue, Cultural accomplishment and Passion for lifelong learning. Their teaching techniques consist on field trips and discussion; the assessment is done through standard tests (Lingnan University, 2016b). The expected abilities are learned during the whole career, through 11 courses and extracurricular events (Lingnan University, 2016a).

National University of Singapore (Singapore). *NUS* encourages undergraduate and graduate students to develop 6 competencies: Questioning minds, Well-rounded mind, Constructive and responsible, Global citizens, Resourceful and enterprising spirit and Communicators. This is achieved through formal and informal education inside and outside the classroom, with techniques such as attend seminars and study trips. These competencies are taught in 5 modules and some flexibility is offered. There is a continuous assessment for students, which constitutes a percentage of the final grade (NUS, 2016).

Alverno College (United States). This college incorporates 8 competencies in both undergraduate and graduate curriculums: Communication, Analysis, Problem solving, Valuing in decision making, Social interaction, Developing a global perspective, Effective citizenship and Aesthetic engagement. The main outcome is to make students continuous

learners. Competencies are defined in developmental levels (Alverno College, 2016). The teaching techniques include simulations and case studies. Evaluation is done through the observation of mentor and student self-assessment. Also, a narrative transcript is given, not a grade (Alverno College, n.d.).

3.2 Medium Level CBE (50% Content Evaluation / 50% Mastery of Competency)

Marylhurst University (United States). This university offers undergraduate programs in which graduation is achieved by a hybrid fulfillment of requirements (Klein, 2012). The developed competencies are 10: Inquiry, Critical thinking, Intellectual breadth, Ethical action, Communicate effectively, Integrate new learning, Interact in a global society, Solve problems creatively, Skillfully weigh complex options and Make effective decisions. Students must complete a set of 19 courses aim at developing such abilities. Teaching techniques include internships and analytical writing. The evaluation is made through a *Core Project* (Marylhurst University, 2016). Students also have to pass traditional coursework.

Wirral Metropolitan College (United Kingdom). This college offers careers in which technical knowledge is acquired and specific competencies of the chosen program, e.g. Team leading and Presentation skill, are incorporated in the curriculum. Students learn independently and assessment methods include assignments and/or *open book* exams (Wirral Met, 2016). Some used teaching techniques are enterprise challenges and simulations (Wirral Met, n.d.). To gain the final certification, in some cases, *Pearson* tests are used.

3.3 High Level CBE (50% Content Evaluation / 50% Mastery of Competency)

Western Governors University (United States). *WGU* main target market is the busy-working adults. Students are not required to pass topic courses, they earn the degree based on the demonstration of competencies. They study at their own speed, taking evaluation when they consider convenient (Klein, 2012). Competencies to be mastered are incorporated in the curriculum, e.g. Critical thinking, Logic, Problem solving, Effective communication, Leadership and Strategic thinking. Teaching techniques include activities such as write papers and do oral presentations. Assessment is done by completing practical assignments and standard tests (WGU, n.d.).

Holland College (Canada). Each program is developed around identified competencies by analysing the National Occupational Classification. Competencies are incorporated in the curriculum, e.g. Critical thinking, Literacy, Numeracy, Teamwork, Problem solving, Time management, Communication, Gender and cross-cultural sensitivity and Professionalism. Some teaching techniques are laboratories and real life situations. The learning is personalized, students develop a career plan with the aid of their mentor. Assessment is

done through evidences and observation. Holland College offers a Prior Learning Assessment process aimed at experienced persons (Holland College, n.d.).

Charles Sturt University (Australia). CSU students are prepared to work. The general competencies to be developed in undergraduate and graduate students are 9: Professional practice, Academic literacy and numeracy, Information and research literacies, Digital literacies, Ethics, Lifelong learning, Indigenous cultural competence, Global citizenship and Sustainable practices (CSU, n.d.). These are incorporated in the curriculum and some learning techniques are workplace learning, role play and scenarios. The assessment is a rubric based and feedback sessions are included (CSU, 2016).

Tampere University of Applied Sciences (Finland). It has a CBE curriculum and the education is personalized. Students begin by developing a study plan with the advice of their mentors. The competencies to develop are incorporated in the curriculum and are specific of each program, e.g. Receptiveness to change, Time management, Ability to interpret information, Work in multicultural environments, Problem solving, Lead people, Be creative innovators and entrepreneurs. Teaching techniques include lectures and participate in R&D projects in enterprises. Evaluation is based on rubrics (TUAS, 2016).

University of Wisconsin Flexible Option (United States). This university offers a flexible and affordable college experience to working-busy adults (University of Wisconsin-Madison, 2013). Competencies are incorporated in the curriculum and are specific of the chosen program, e.g. Interpersonal skills, Project scope analysis, Risk analysis and Personal selling. Teaching techniques include: essays and recorded presentations. Evaluation is direct, done through tests, observations and rubrics. Students with competencies learned previously can take an assessment and gain the credits (University of Wisconsin System, n.d.).

University of Michigan (United States). This organization offers the Master of Health Professions Education focused on CBE (Observatorio de Innovación Educativa, 2015). To gain the degree, the learner must complete activities that a health professional educator will perform at work. Specific competencies of the program are developed, e.g. Educational methods and Personal leadership skills. To learn and practice them, the student must perform activities such as to criticize a curricular change. Evaluation is done through a documentation and evidence process (University of Michigan n.d.).

Low level CBE organizations have mainly defined general competencies. These are developed both in specific classes or incorporated in the curriculum. Medium level CBE have mixed results. In one organization, competencies are specific of each program and hence developed embedded in the curriculum. The other has defined general competencies for its students, which are taught in particular courses. In high level CBE, the majority of

organizations have defined specific competencies for each program, which are developed implicitly into the curriculum.

4. State of the Art

Taking in consideration the previous analysis of CBE universities/colleges, the main up to date practices are described. The general competencies promoted ranges from 6 to 10. However, the quantity of abilities can be high in colleges, as these are more specific. Figure 2 presents the general competencies most often developed, emerging general competencies worth noting and examples of teaching methods.

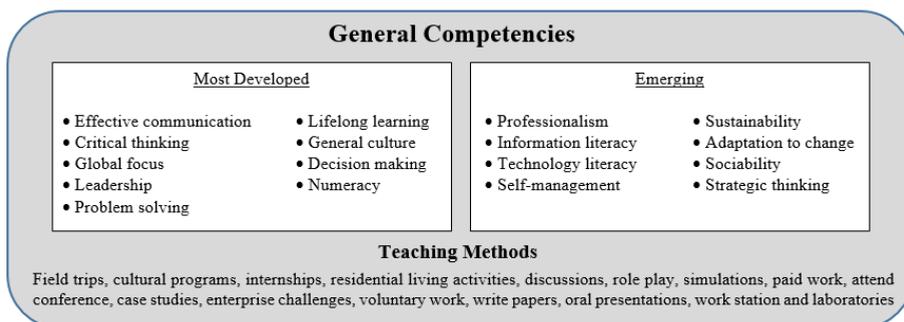


Figure 2. General competencies, emerging competencies and teaching methods. Source: Own elaboration.

Table 1 shows the competency development formats, examples of evaluation methods and how the students' progress is reported by the organizations under study.

Table 1. Competency development formats, assessment methods and progress report

Development formats	Assessment methods	Progress report
a) In specific courses, e.g. Lingnan University develop competencies in 11 courses	a) Standard test, e.g. Information Technology Fluency Test and Pearson vocational tests	a) Pass or not pass grade
b) Embedded in the curriculum, competencies are acquired during the whole program	b) Evidences, e.g. papers published, grant applications, video presentations c) Rubrics, portafolio of projects, mentor observation	b) Narrative transcripts c) Oral and written feedback

In the QS Graduate Employability Ranking 2017 (QSIU, 2017) the organizations under study that appear and ranked higher are: NUS (#21), University of Michigan (#27) and University of Wisconsin (#91). NUS main education characteristic is flexibility with intellectual rigorousness. It is committed to develop competitive students. Proof of the above is that it is continuously scanning what happens in the industry, through the Centre for Future-ready Graduates, wich main goal is to develop students with the demanded skills by the worldwide productive sectors (CFG, n.d.).

CBE approach of organizations analysed gives important benefits under student's perspective, e.g., some Marylhurst University graduates argue that flexibility is a value added. Also, they were able to apply the learned concepts immediately at work (GradReports, n.d.-a). In WGU, one important advantage for the students is gaining credits from previous experience, which speed up graduation. Besides, they can balance academic, personal and laboral life (GradReports, n.d.-b). According to University of Wisconsin Flexible Option students, CBE approach let them improve current job skills in a short period of time. Also, the investment is relatively low, having a good return on it (University of Wisconsin System, 2014).

5. Conclusions

CBE is an educational approach with emphasis on outcomes. Its main advantage is that measures what a student can do after completing a program. CBE is quite flexible, universities/colleges of any size/age can incorporate it, depending on their resources and strategies. Universities/colleges from different countries were analyzed; they exhibit different levels of CBE implementation, ranging from those having a traditional curriculum, with competencies being a minor part of evaluation, to those in which the mastery of solely the competencies is the main goal. Universities seem to have well defined general competencies to promote. They vary from 6 to 10, and are mostly taught in specific courses. In colleges, competencies are specific of each course/program and are embedded in the curriculum. Competencies such as effective communication and global focus are mostly promoted. However, there are other interesting ones: self-management and sociability.

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Student Auditing of University Social Responsibility - Reform through Reflective, Experiential Learning?

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Abstract

The emphasis on the social responsibility of higher education institutions emerged more systematically in the Post-Bologna European context. This paper presents an overview of an ERAMUS + Strategic Partnerships Project on certificate university social responsibility auditing, currently underway in three very different European universities. The overall goal of the Project is to develop auditor training for students based on experiential learning, that is coherent and replicable in diverse contexts and that involves a diverse range of internal and external stakeholders. The project is based on a set of Benchmark Standards for University Social Responsibility developed in the context of an earlier ERASMUS Lifelong Learning project. These Standards cover four main areas, namely (1) Research, Teaching, Support for Learning and Public Engagement, (2) Governance (3) Environmental and Societal Sustainability; and (4) Fair Practices. In this paper, we will report on the initial data generated by the Project, in respect of student recruitment, baseline attitudes and the impact of participation in the training and the first audit.

Keywords: *university social responsibility; student training; experiential learning; audit .*

1. Introduction

The emphasis on the social responsibility of higher education institutions (HEIs) is frequently assumed as being a relatively recent phenomenon (e.g., Larrán, López & Márquez, 2011), even if there are references to this role since the early 20th century (e.g., Chase, 1923), and a social purpose of one sort or another is arguably integral to the very nature of higher education and the notion of the “university”. A more systematic approach has emerged in the European context, post-Bologna, under the umbrella term of “the social dimension”. Nevertheless, one stand of the Bologna Process Implementation Report (2015) has profound implications for “university social responsibility”:

“Within the European Higher Education Area, countries have committed to the goal that the student body should reflect the diversity of the populations and that the background of students should not have an impact on their participation in and attainment of higher education.

While some progress can be noted, the analysis clearly shows that the goal of providing equal opportunities to quality higher education is far from being reached.” (European Commission/EACEA/Eurydice, 2015: 19)

The implication of this is that policies and practices that promote equity, justice and democracy in higher education are still a significant challenge.

In this sense, the idea of University Social Responsibility (USR) and the recently developed Benchmark Standards for University Social Responsibility across the EHEA (Martin, 2016) can play a central role not only conceptually, but also in practical terms by guiding intervention efforts in this domain. Recognising the imperatives of widening access to higher education to help ensure that the diversity of European society is reflected in the student population and barriers to entry, progression and attainment are effectively addressed, these Benchmark Standards foreground Research, Teaching, Support for Learning and Public Engagement as the first of four areas within which a European University can be expected to evidence its commitments to social responsibility. This distinctive, sector-specific focus complements the more generic perspective of the International Standards Organisation’s ISO 26000, Guidelines on Social Responsibility (2010 and 2012). The three other topics covered in the USR Benchmark Standards are closer to the ISO’s concerns though even these (Governance, Environmental and Societal Sustainability and Fair Practices), have been specified in relation to Europe’s higher education sector and its distinctive history and nature.

However, the emergent nature of these Standards together with the fact that the rapidly developing field of USR is extremely diverse and prone to conceptual misunderstanding, presents both a need and an opportunity to explore how exactly such Standards might help inform policy and practice in relation to progression and attainment on one hand and the

growing challenges of – for example – graduate employability on the other. The rest of this paper presents an overview of the current Project that we are all involved with, as a case study of one current exploration of these issues.

2. A Certificate in University Social Responsibility Auditing

In a historical analysis of the functions of higher education, Zgaga (2009) identifies four archetypal models that remain relevant in contemporary policy documents (e.g., the 2007 London Communiqué). The *Napoleonic* model underlines the preparation of students for their future professions; the *Humboldtian* model values the development of knowledge and research; the *Newmanian* model accentuates the personal development of students; and *Deweyan* models focus on promoting community engagement and citizenship. These are not either-or goals of HEIs but rather coexist in both discourses on the role of higher education and in the practices of individual universities.

The ESSA project (<http://www.essaproject.eu>) funded by European Commission Erasmus+ Programme, reflects this multidimensional vision by involving students as active agents in their universities through a Certificate in Social Responsibility Auditing with focus on University Social Responsibility (USR). The training strand of the Certificate programme and the topic itself accommodate the development of both personal and civic and political competences that should help students maximise the benefits available to them from the later stages of their 1st cycle studies and from any further study they might undertake, enhance future employability and engage them in a deeper and more productive relationship with both their own university and higher education more broadly. This rationale underpins the development of ESSA in its various components. This Certificate is an elective course that functions as an extra-curricular activity, to be mentioned in the students' diploma supplement in all participating universities and students will have 10 ECTS related to this programme.

The main project objectives are to develop and deliver (i) a facilitator training manual, (ii) a (student) auditor training programme (in blended mode and incorporating experiential and participative action learning in a social responsibility audit of the 'performance' of a university in another European country) and (iii) an assessment scheme with the assessment requirements for the award of a ECTS 10Credit Certificate in Social Responsibility Auditing (<http://www.essaproject.eu>). The intention is to bring these, the audit guidelines and the various tools, instruments and materials developed in the course of the project together in a substantial Open Educational Resource (OER) that will be grounded in and celebrate reflective experiential learning (e.g., Schon, 1987) as a key to addressing some of the challenges and barriers encountered in addressing the widening access agenda.

A focal point in both the work of the project itself and in the student/learner's experience will be the latter's participation in one of four audits, which have been conceptualised and are being designed and developed to aid not only individual learning and development but also organisational development for the participating universities.

The project partnership includes the University of Porto, University of Edinburgh, Kaunas University of Technology, and their respective student associations together with the European Students Union (ESU) and the UK's National Union of Student, the project's coordinating partner. Ultimately, the outcomes from the project and the OER itself will be reported to a trans-national European conference to be coordinated by ESU. At that conference, ESU (<https://www.esu-online.org>) will launch arrangements for the roll-out of the Certificate Programme across the EHEA as a whole.

2.1. Social Responsibility Audit: Meanings and importance

Until now, the assessment of universities has "tended to focus solely on the academic aspects of their activities, namely research and teaching. Even the ones which extended the range of dimensions by which to assess universities does not include the dimension of social impact of universities" (Leichsenring, 2016: 2). This gap can be overcome through the social responsibility audit process.

A basic definition of social responsibility auditing would present it as a process that enables an organization to assess and report its performance in relation to society's requirements and expectations, making it more transparent and accountable. Such a review would help to ensure that the organization gives due consideration to its wider social responsibilities, balanced with its own more specific objectives (Gao & Zang, 2006), beyond a focus on social mobility articulated as enhancing individual employability within competitive labour markets (Williams, 2014).

Thus, a social responsibility audit would help narrow gaps between public policies, societal expectations, institutions vision/ goals and reality through giving voice to all stakeholders, involving them in the process of change (Jain & Polman, 2003). For Higher Education as a sector, and for Europe's HEIs, this could be a powerful key to successful implementation of the changes required to properly address the established and emerging needs, expectations and requirements of society as a whole. Further, it could be a significant means of contributing to realisation of each of the stated goals of the European Commission for its lifelong learning programme: active citizenship, employment and personal fulfilment (European Commission, 2015).

2.2. Social Responsibility Audit Training as a Focus for Change

The main focus of the project is the training of student auditors. The high level of engagement proposed for them and the need for raising awareness of participants' own

agency in both the institutional and wider environments, combined with an introduction to the concepts and skills associated with social responsibility and auditing, are key features of the training. The training rests on the fundamental principles of (i) reflective experiential learning and student-centered approach, (ii) a balance between training and practice experience, with the involvement of students in the direct application of their knowledge and competences in a live, 'for-real' audit and (iii) a social vision of auditing that will foster the transference of learning to participating institutions, but will also enhance students' future employability and citizenship.

Experiential learning is a powerful way to address individual growth and potential, by focusing on the individual learning through experience process – "learning through reflection on doing" (Dewey, 1963). Experiential learning is adaptable for individual style, preferences, strengths, direction, etc. As such, it is more likely than conventional prescribed training or teaching to produce positive effects, notably confidence, and a sense of personal value and purpose. In a student-centred learning approach, the student should be closely involved in the construction of the learning process (rather than getting the 'right' answers), to increase her/his awareness and capacity to identify problems, their causes, and possible solutions.

Student involvement in the audits is also expected to have a significant influence on their development as aware, engaged, critically active citizens and on their own empowerment, as it creates "a suitable framework for the institutionalization of student social involvement and greater social awareness on the part of the institutions themselves." (ESPRIT, 2016). As stakeholders, being part of the university needs to be an experience that enables students to participate successfully in processes or systems not just be taught, study independently and/or collaboratively and produce work for assessment. We will report and comment on the initial data generated by the ESSA Project, in respect of student recruitment, baseline attitudes and the impact of participation in the training and the first audit scheduled to be undertaken in the University of Edinburgh from 24th to 28th of April of 2017.

2.3. 1st cohort of student auditor recruitment and training: initial data

The first student auditor recruitment and training was developed by the three Universities involved between 3rd March and 19th April. Both recruitment and training were not simultaneous but fulfilled the same structure in terms of guidelines, description, hours of training and learning outcomes.

2.3.1 Students recruitment

The student's recruitment was open to third year undergraduate students and above (including masters level students) who had an interest in social responsibility and

sustainability and fit the student auditor role designed by all the partners and defined as the ideal candidates. The skills and knowledge asked were:

- Good communication skills, both verbal and written, and confidence in face-to-face engagement;
- For international students whose first language is not English, students would have to be fluent in English;
- Confidence to work independently and in a team and able to assist fellow student auditors to identify creative solutions to problems;
- Good analytical and research skills;
- Excellent time management and leadership skills;
- Some knowledge of the workings of universities and and of social responsibility and sustainability issues and initiatives.

In the first cohort of the student audit training there was a total of 32 participants, which included 17 students from University of Porto¹, 6 from Kaunas University of Technology and 9 from University of Edinburgh with ages raiging from 19 to 35 years, mostly female and from a variety of study areas, as described in Figure 1 and Figure 2.

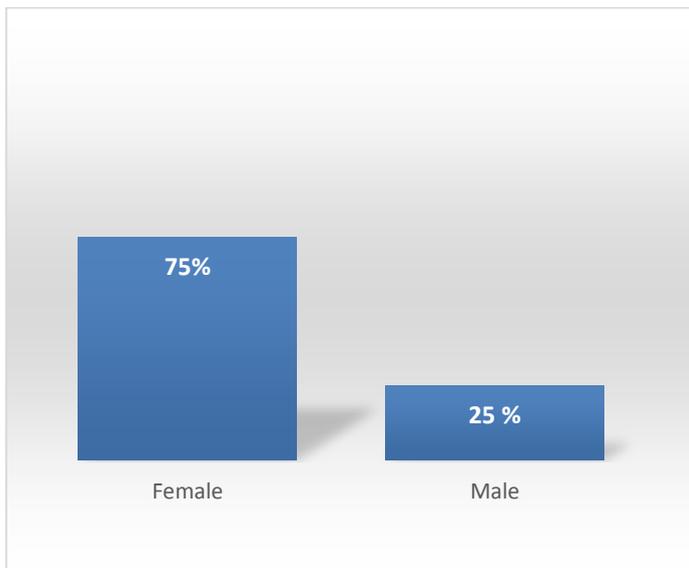


Figure 1. Participants' gender

¹ The University of Porto chose to do over recruitment to guarantee the number of students needed for this first and second audits, given the previewed calendar of the second training and its possible interference with the students' final assessment periods.

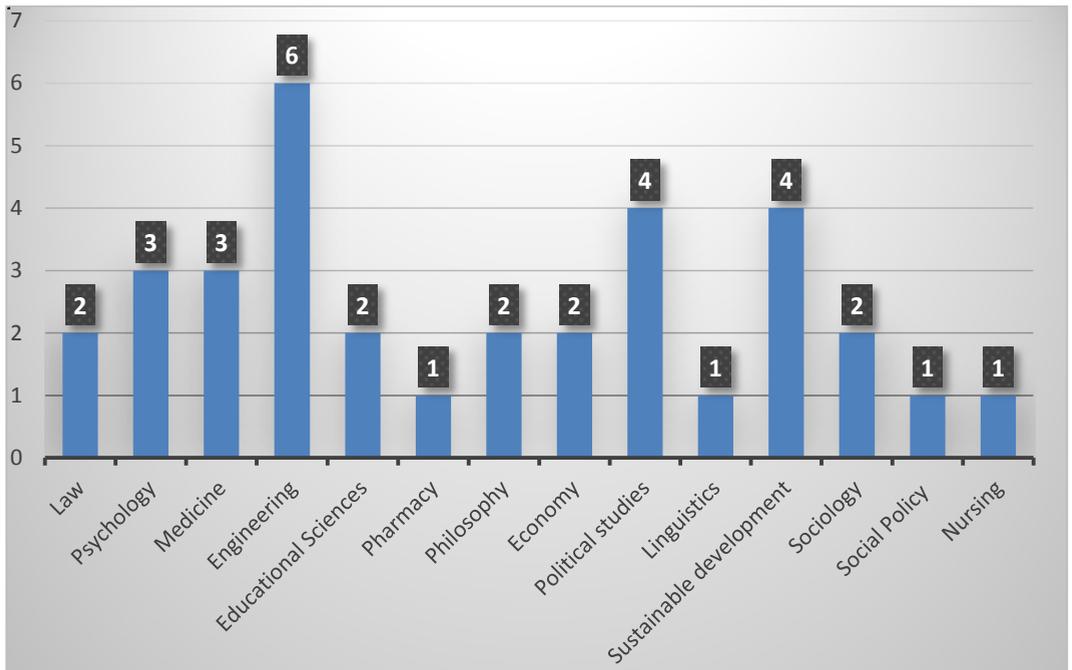


Figure 2 Participants' area of studies

2.3.2. Students audit training phases

The Students Audit Training Programme was developed in two parts: a student audit training and the auditing of a university. The three universities completed the 1st part of the training generally the same way in three different, but interconnected, phases:

- **Phase 1** comprised the online pre-course, which included a preparatory package with some key readings and videos recommended on the topics of the training in order to prepare a mind-set for the training week and the beginning of an individual training journal, a personal report where the participants were invited to record, on a daily basis, his/her expectations, regarding the training, as well as their individual learning experience.
- **Phase 2** was the face-to-face training week, which was divided in three main topics that were considered the most relevant: the USR concept and benchmarking; the Social Responsibility Audit; Simulations of audits and Report. In the beginning of this phase was made the 1st training survey.
- **Phase 3** included the online post-course activities, which were self-evaluation activities.

The second part of the training included conducting a supervised social responsibility audit of a university, is scheduled to be developed in the University of Edinburgh from 24th to 28th of April of 2017, so there is no data from this stage available at the time of writing².

2.3.3. Student Auditor Training 1st survey: preliminary data

The 1st part of the student auditor training was completed by all the universities and the 1st training survey questions were subject to content-analysis. The emerging categories relate to motivations, personal learning objectives and expectations. The results of the content analysis are summarized in Tables 1 to 3. This is followed by a discussion on the key points emerging from this data. The categories in bold characters are those most frequently referred to.

Table 1. Motivations

Opportunity to learn more about USR
Opportunity to learn more about auditing
Opportunity to work in an international/European project
Opportunity to acquire/develop new skills
My interest in the theme
New opportunity for personal development
Opportunity to improve my own university
Contact with projects/field work
Possibility to apply principles/global impact
Possibility to work with Sustainability Auditing
Being a part of a wider project

The participants repeatedly highlighted three different motivations to participate in the project. For some it was the opportunity to learn more about auditing and actually perform audit: "the possibility to apply principles I have learned during lectures to a real-life situation" (Female, UoE); the possibility to learn more about USR: "I am very interested in learning more about University Social Responsibility" (Female, UPorto). For others, it was the opportunity to have the experience of an international project in this area: "To be part of an international project about such an important topic" (Female, UPorto). Other motivations related to the possibility to apply knowledge in the field and the interest for the theme: "The topic itself and the fact that besides the theoretical knowledge the project had also a practical part." (Male, UPorto)

² We anticipate being able to share that data in the course of our presentation at the conference however.

Table 2. Personal learning objectives

Develop knowledge about social responsibility audit
Be able to analyse USR performance
Improve analytical and research skills
Understanding university social responsibility
Understand how universities are managed and work
Develop skills in reporting

In terms of the learning objectives, all students referred objectives connected with the development of specific skills, whether more general academic skills: "Improve analytical and research skills" (Female, Kaunas) or specifically related with their performance as an auditor in USR: "be able to conduct interviews and focus groups ... as tools to carry out an audit and collect data"(Male, UPorto). Some of them even go further and relate the personal learning objectives with a larger goal to understand how universities are managed and work and "social responsibility as a social integration strategy" (Female, UoE).

Table 3. Expectations

Learn how to audit social responsibility
Improve academic/ research skills
Get to know other universities reality on social responsibility issues
Really audit a university
Learn about criteria for assessing sustainability and social responsibility
New opportunities
Get useful knowledge for academic studies and participation in university

After the first part of the training, the students stated that they expected to match some of their personal learning objectives and their motivations (skills development, learn more about the audit USR process) to the possibility of knowing how USR issues are put into practice in other European universities: "I am looking forward to observing how universities of different countries may use different approaches to pursue social responsibility as well as uncovering the underlying factors of these variations" (Female, UoE).

3. Conclusion

Assuming that active citizenship needs to be learned in practice and that "*educational institutions need to teach systematically how to participate in society*" (Leichsenring, 2016 :1), the USR audit training aims to empower students as critical agents of social responsibility in a way that helps facilitate a fundamental redistribution of rights (Frazer,

1998) in Europe's HEIs, in addition to improving and enhancing the student experience itself and addressing challenges to progression and attainment.

From the first survey, it appears that students also valued this aspect and welcomed the opportunities to work outside their disciplinary areas and to support their institution in enhancing its social impacts. The diversity of student's areas of studies is very marked, suggesting that this is a transversal topic that interests students, whether they are involved in the social sciences or to more technical areas such as engineering or health.

The project represents an opportunity for students to address complex problems in HE with an approach that integrates the four archetypal models proposed by Zgaga (2009), that is, combining personal, professional, research-oriented and civic-political roles. As one participant student concluded "USR borders are much more wide and comprehensive" involving the HEI's "traditional commitment to the social tissue in forming a critical, visionary and sustainable generation" but permeating "the management of all University processes" (Male, UPorto).

We hope to present further updates on the data emerging from this Project at future HEAD Conferences and a full account of the impact of the project on student participants at HEAD 2020.

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Getting in and getting out: Predicting the likelihood of graduation of master's program students

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Abstract

We assess the predictors of the likelihood that a student will graduate from the master's program of a business university. We use data from three years of a master's program, totaling 455 students. The methods used are bivariate tests and logistic regression analysis. We find that the likelihood of a student graduating from the master's program is positively related to the student i) holding their previous degree from business, as opposed to another field, ii) moving from another country to take the master's program, and iii) taking up a master's program with a qualitative, rather than quantitative, orientation. Interestingly, we find no evidence to suggest that whether a student's previous degree is from a research university or from a practically oriented polytechnic would be related to the student's odds of graduating. The results are relevant for master's program teachers who can benefit from taking into account their students' varying backgrounds, and for people responsible for planning the selection criteria and implementation of master's programs. The results are also encouraging for polytechnic students who are contemplating taking further studies at a research university.

Keywords: Admission criteria; completion of studies; graduation; master's program; master's studies; polytechnic.

1. Introduction

As admission to universities is limited, universities use a variety of student selection criteria. The aim of these criteria is to ensure that students have the appropriate background, competencies, and motivation to successfully complete their university studies. It is typically in the interests of universities and students alike that students eventually graduate. The amount of public funding received by a university can also be tied to the number of graduations. It is therefore important to attract and select students who are likely to graduate.

Existing research assessing the ability of admission criteria to predict master students' academic success is not entirely consistent in its findings. Studies regarding the influence of standardized test scores and undergraduate grade point averages (GPA) have yielded varying results (Calisir et al., 2016; Clayton & Cate, 2004; Graham, 1991; Marks et al., 1981; Zhang et al., 2004). For example, Zhang et al. (2004) found that standardized test scores and previous GPAs are significant predictors of graduation, whereas Clayton and Cate (2004) did not find them significant. Fastre et al. (2008) found that the quantitative skills of master business students are positively related to a background in business and to university-level bachelor's degrees. They also found that students entering a European university from outside Europe have higher quantitative skills than their colleagues. Zhang et al. (2004) showed that ethnicity and citizenship are significant predictors of the likelihood of graduation in some universities but not in others. Lamadrid-Figueroa et al. (2012) and Zhang et al. (2004) both highlighted that gender or age are not significant in predicting the odds of graduation.

In this paper, we investigate the predictors of the likelihood that a student will graduate from the master's program of a business university. We examine the influence of students' educational backgrounds, age, gender, and the orientation of their major subjects on the odds of graduation.¹ We thereby seek to contribute to the existing body of research on factors affecting the likelihood of graduation.

¹ Due to data availability restrictions, we do not assess the impact of standardized test scores or previous degrees' GPAs.

2. Method

2.1. Data collection

We use data from the master's program of a Finnish business university. The sample includes students who entered the master's program in 2009, 2010, and 2011.² These entry years were selected in order to allow for sufficient time to have passed for the students to have graduated. The data were sourced from the internal student information database of the university.

2.2. Variables

Graduation is the dependent variable of this study. It is an indicator variable with the value of 0 for students who have not graduated and 1 for students who have graduated by 2017.

The four independent variables of this study are described below.

Type of previous degree. Higher education in Finland is offered by research universities and by polytechnics. Research universities emphasize scientific research, whereas polytechnics adopt a more practical approach. Bachelor's degrees from both research universities and polytechnics provide general eligibility for master's degree studies, and the sample contains students with both types of degrees. This variable is valued at 0 for polytechnics and 1 for research universities.

Study field. An indicator for whether or not the student's previous degree is in the same field as the master's program, i.e. business. Valued at 1 for business degrees and 0 for others.

Country. Indicates whether the student's previous degree is from the same country as the master's studies, i.e. Finland. Valued at 1 for degrees from Finland and 0 otherwise.

Orientation. An indicator variable showing whether the student's major in the master's program is quantitatively (1) or qualitatively (0) oriented.³

In addition, we use two control variables, which are described below.

Age. The age, in years, of the student when s/he entered the master's program.

Gender. An indicator variable with the value of 0 for male students and 1 for female students.

² Students who continue directly from a bachelor's degree to master's studies at the same university are not included, as they do not need to apply for the master's program.

³ Majors in business, management, leadership, communication, law, entrepreneurship, marketing, and strategy were classified as qualitative. Economics, management science, accounting, finance, and information technology were classified as quantitative.

3. Results

3.1. Description of the sample

The sample consists of 455 students with previous degrees from 96 different universities and polytechnics from around the world. Their previous degrees are typically from the fields of business or engineering, although several other study fields, such as law and political science, are also represented. The majority (55%) of the students are women. 70% of the sampled students graduated from the master's program, with women graduating somewhat more often (75%) than men (64%). The median age at the time of entering the master's program was 24 years for students who proceeded to graduate and 26 years for students who did not graduate.

3.2. Bivariate analysis

Table 1 presents the number and share of students split according to whether or not they graduated, separately for each categorical variable value. It is noteworthy that 76% of students with business degrees graduated, in contrast to 54% of students from other fields. Likewise, 59% of students in quantitatively oriented programs graduated, which compares to 75% in qualitatively oriented programs.

Table 1. Number of students in each category and χ^2 test statistics.

	Characteristics of previous degree						Master's program	
	Type		Study field		Country		Orientation	
	Uni- versity	Poly- technic	Business	Other field	Finland	Other country	Quanti- tative	Quali- tative
Graduated	237	82	255	64	266	53	79	240
%	68%	75%	76%	54%	69%	75%	59%	75%
Did not graduate	109	27	82	54	118	18	54	82
%	32%	25%	24%	46%	31%	25%	41%	25%
Total	346	109	337	118	384	71	133	322
χ^2 test statistic	1.8		19.2		0.8		10.3	

Chi-squared tests were performed to assess whether each of the four independent variables has a statistically significant association with the number of graduations. The critical value of the chi-squared distribution at a significance level of $\alpha = 0.05$ is $\chi^2(1) = 3.84$. The data thus show sufficient evidence to indicate that whether or not a master's program student will graduate depends on the field of their previous degree, with business students more likely to graduate, and on the orientation of the master's program, with students in

qualitatively oriented programs more likely to graduate. The bivariate tests do not indicate that graduation would depend on the type or country of the previous degree.

3.3. Logistic regression to assess the likelihood of graduation

Logistic regression was used to model the relationship between independent and control variables and the likelihood of graduation. In order to yield a parsimonious solution, regression was run hierarchically, gradually including the independent and control variables as well as their interactions⁴. The resulting model is presented in Table 2.

Table 2. Results of logistic regression to predict likelihood of graduation.

Variable	Coefficient (b)	St. error	95% confidence interval for odds ratio		
			Lower	Odds ratio	Upper
Constant	2.78***	0.83			
Type	-0.18	0.30	0.47	0.83	1.48
Study field	0.82***	0.26	1.35	2.26	3.80
Country	-0.54*	0.32	0.31	0.58	1.09
Orientation	-0.56**	0.24	0.36	0.57	0.91
Age	-0.07***	0.02	0.89	0.93	0.97
Gender	0.29	0.23	0.86	1.34	2.10

Note. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. $R_L^2 = 0.08$ (Hosmer & Lemeshow), $R_{CS}^2 = 0.09$ (Cox & Snell), $R_N^2 = 0.13$ (Nagelkerke). $\chi^2(6) = 42.18$, $p < 0.001$.

The model represents a statistically significant fit for the data, as indicated by the chi-squared statistic which is significant at 0.001 level. The model does not suffer from multicollinearity, as indicated by tolerance values and variance inflation factors⁵. It also

⁴ Interactions were excluded from the final model, as they did not contribute to the explanatory power of the models in a statistically significant manner.

⁵ Collinearity diagnostics were obtained by running a linear regression model with the same independent and dependent variables. The resulting model's tolerance values for each variable range from 0.781 to 0.943, while Menard (2011) suggests that tolerance values below 0.2 can raise concerns about multicollinearity. The variance inflation factors range from 1.060 to 1.281, while Myers (1990) suggests that any value greater than 10 indicates a problem with multicollinearity.

satisfies the assumption of linearity⁶. The study field of the previous degree, the orientation of the master's program, and the age of the student are related to the likelihood of graduating in a statistically significant manner. The country of the previous degree is also statistically significant, albeit weakly. The type of the previous degree and gender are not related to the likelihood of graduation.

3.4. Insights from students

To build an understanding of the reasons underlying the identified relationships, we asked 45 master's program students via e-mail for their views of what influences their likelihood of graduating, receiving nine responses. Students from other countries or from polytechnics had sometimes initially faced challenges in adapting to the high level of independence and to the processes specific to a Finnish research university. However, after overcoming these challenges, high motivation emerged as a key strength. Students from both categories were motivated by a high freedom of choice and of opinion. The motivation of students from other countries was positively influenced by the opportunity to end up with two degrees from two different countries. Students from polytechnics were motivated by the new type of study environment and methods. Some were also driven forward by a willingness to demonstrate that they were equally capable of succeeding as their colleagues with backgrounds in research universities. Previous business studies were also seen as a strength for the ability to complete the program.

⁶ The linearity of the relationship between the continuous control variable (age) and the log of the outcome variable was tested by including the interaction between age and the natural logarithm of age in the logistic regression. The interaction term is not significant at 0.05 level, which indicates that the assumption of linearity has been met.

4. Conclusions

4.1. Discussion

The bivariate tests and logistic regression gave results that are consistent with each other. They were further supported by the views obtained from students. The results are summarized in Figure 1 and discussed in what follows.

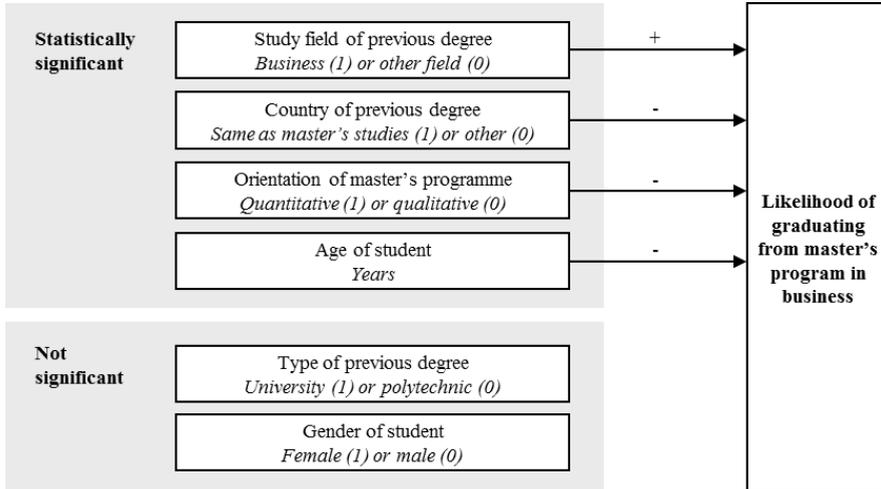


Figure 1. Illustration of the results.

A student having studied business in their previous degree is positively related to the likelihood of graduation. Students from fields other than business may be less likely to complete their master's studies because they may lack the necessary foreknowledge to successfully complete the business studies. Alternatively, they may be less motivated to complete their studies, as they already hold a degree from another field and may perceive the master's studies more as a way to selectively complement their education, rather than to earn a new degree. Furthermore, their preconception of business studies may have differed from reality, which may deter their motivation.

Students with previous degrees from abroad are more likely to graduate than those who completed their previous degree in the same country as the master's program. Students who come from abroad may have higher motivation to complete their master's studies if they have moved country because of the studies. Cultural differences in the attitude towards education may also play a role, with students from some other countries having more of the mindset that enrolling in a university implies the intent to also graduate.

A student attending a qualitatively, rather than quantitatively, oriented major in their master's program is positively related to the likelihood of graduation. Quantitative study

fields have typically knowledge requirements of a more cumulative nature than qualitative fields. Hence the ability to complete a quantitative degree may be more reliant on the skillset that a student has acquired earlier on in their studies, which may complicate proceeding to graduation if that skillset is not fully in place.

Interestingly, there is no relationship between graduation and whether a student holds their previous degree from a research university or from a polytechnic. While students from polytechnics may need to acquire more new skills in order to complete their master's studies, they may also have a higher motivation to gain a university degree than their colleagues who already hold one degree from a university.

4.2. Relevance

The results are relevant for teachers of master's courses and for the admission boards of master's programs. They may benefit from taking into account that certain characteristics of students' previous degrees can be related to the students' ability or motivation to complete their master's studies. In particular, students with a degree from a different field may need extra motivation or support. It is also useful to take into account that students with a polytechnic background can be equally, if not even more, likely to complete their university-level master's studies as students with a university background. The results are also encouraging for polytechnic students who are contemplating taking further studies at a research university.

4.3. Limitations and future research

While our sample consists of a large data set, student groups with certain types of backgrounds, such as students coming from certain schools, are more heavily represented than others. Future research could include master's programs from additional universities. It would also be interesting to complement our results with a more extensive assessment of the reasons underlying the observed relationships. The results have been obtained from a country in which higher education was free of charge to all students. They may thus not be generalizable to institutions with study fees, as cost may affect motivation.

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Academic Managers` Perspective on Research Management in Higher Education Institutions across Romania

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Abstract

This paper seeks to bring into discussion the main traits and their effects on the research management process within Romanian universities from the managers' perspective. Fourteen academic managers took part in a semi-structured in-depth interview aimed at presenting and analysing the research management process in higher education institutions. The focus was on academic managers' perspective regarding the current university model, the research culture within universities and the internal strategies used to promote and stimulate research production. Results show the university should be considered an important pillar for economic growth and thus, it must invest in developing more research activities of higher quality, helping to transform knowledge into a profitable investment. Therefore, the university needs to support the development of internal strategies that will help researchers work individually or in teams in order to implement research projects, ensuring that potential inaccuracies, such as lack of institutional support or bureaucracy, are reduced.

Keywords: *research management; university; Romania.*

1. Introduction

The status quo of higher education is in a constant change due to increasing demand in the contemporary society. This brings the necessity of reforming and restructuring the universities in order to become more responsive to the needs of the global knowledge-based society (Marginson, 2010). To do so, universities must invest in strengthening their research capacity not only to contribute to the society's development, but also to find ways to differentiate from other higher education institutions (HEI). This differentiation is generally related to teaching and performing public service, but also to engaging in winning competitive research funds from government or industry, because research is the activity that differentiates among and within universities (Slaughter and Leslie, 1997). Therefore, universities must develop an internal research paradigm (Maassen, 2000).

The literature points out several characteristics of research at university level: it lacks coherent theoretical and methodological frameworks (Scott, 2000), as well as stability and quality (Teichler, 2000) and it tends to be created in broader, transdisciplinary social and economic contexts in response to specific problems in order to meet a range of users' needs (Gibbons et al., 1994). Also, it appears that academic research has a fairly low impact on policy and does not manage to meet the decision-makers' needs (Blunkett, 2000; O'Dwyer, 2004; Levin & Edelman, 2010; Cherney, Povey, Head, Boreham, & Ferguson, 2012).

Engaging in research activities means investing in the process of shifting from a traditional university model centred on teaching to a more complex model, where HEI place a greater importance on academic development regarding three main pillars: teaching, research and economic development. When it comes to the university's mission insofar research is concerned, the first aspect to consider appears to be the development of a research culture within university. An understanding of the research culture is presented by Evans (2009) as a set of shared values, assumptions, beliefs, rituals and other forms of behaviour, whose central focus is the acceptance and recognition of research practice and output as a valued, worthwhile and pre-eminent activity.

2. Methods

The data presented in this article are drawn from a project funded by the Ministry of Education through the Romanian National Authority for Scientific Research and Innovation, which aims to analyse the impact of educational research mobilization on policy-making.

The data-gathering process involved four phases, comprising of both quantitative and qualitative data: (1) a targeted survey of 347 academics in the field of education from 17 public universities in Romania; (2) 14 semi-structured in-depth interviews with academic

managers; (3) 13 semi-structured in-depth interviews with a selection of policy-makers/experts in the field of education; and (4) 3 focus groups with a select group of academics, academic managers and policy-makers. Results reported hereby are based on phase 2.

2.1. Participants' profile

Interviews were conducted with 14 academic managers from research intensive universities and research-teaching universities in Romania. The profiles of the interview participants are given in Table 1.

Table 1. Participants' profile

Participants' profile	N:
Heads of departments	9
Vice rectors responsible with research activities	3
Vice deans responsible with research activities	2
Total	14

2.2. Data analysis

The interviews were conducted over a period of 5 months between March and July 2016, have a duration between 30 and 180 minutes and have later been transcribed and validated with the participants. All transcripts were coded using line-by-line analysis in accordance with Glaser & Holton's (2004) guidelines on coding for grounded theory. The Maxqda 11 software for qualitative data analysis was used to facilitate coding, data management and promote transparency. The interviews targeted, amongst others, open-ended question about the research management process in higher education institutions, namely the university model, the research culture within universities and internal strategies to promote and stimulate research production. The code used to identify interviews in this article is I1 to I14.

3. Results

3.1. The university model in transition

By focusing on the university model in general, the respondents tend to frame universities in a traditional and comprehensive model, that brings together different study areas (vocational, social sciences, social sciences and natural sciences) and describe it as having *'a unique complexity that brings together different study areas'* (I9).

Making the shift from a teaching centred-university to a research-centred university is a natural process, agrees the dean of one of the oldest universities in Romania: *'we can speak of a historical pattern; traditionally, universities' aim was to form the social and political elites, but nowadays the university is already defined by the Humboldtian model focusing on encouraging productive thinking'* (I12).

Moreover, some academic managers placed an emphasis on yet another university model: the entrepreneurial university. Therefore, the university should be seen as a community-centred university that aims at developing a strong collaboration with the social and professional sectors. Academic managers believe the university has to adapt to the entrepreneurship sector and to the economic environment in order to contribute to economic growth, to transform knowledge into a profitable investment and to provide educational services in order to meet the demands of the labour market. The great challenge is to identify the way in which *'academic knowledge brings profit'* (I12).

When talking about the research activity within universities, the 'traditional model' is the one that best describes the Romanian universities. This model is associated with the fact that a research area strictly develops only if a researcher has a particular interest in that topic. One of the interviewees, Head of Department, agrees that:

'the researcher is the one that helps a research area to spread its importance, not vice-versa, meaning that the research process is still a sum of individual achievements, rather than a joint effort of a team of researchers' (I14)

Even though there is a desire to move towards a research-centred university, there also appear to be some challenges: the funding mechanisms within universities are exclusively based on the teaching perspective (funding is strictly based on the number of students). This situation is best described by the Dean of an Education Science faculty, who states:

'I think there is a problem: we want to move towards a model that is centred on research-based universities, but funding is granted only on a numerical criteria - the number of students determines the budget that the institution receives' (I11)

3.2. Research culture

When it comes to the research culture within universities, there are some key issues that show there is still no clear vision on this concept, as stated by one of the interviewed academic managers: *a coherent culture, at university level, does not exist, neither does a culture of research in general` (I8).*

The key issues are related to the lack of clear values and the lack of an environment that would foster the impact of research on social development. Other key aspects are related to the fear of cooperation among researchers, a lack of recognition of the researchers' status both within and outside the academia, and the persistence of the `traditional` model.

Despite the aforementioned fear of cooperation, at least at a declarative level both individual and team research activities are valued. In terms of individual work, the research activity is closely related to the individual career development: *`it comes to one's interests, concerns, passions` (I10).* This represents one particular motivational factor for engaging in research activities, along with the professional and academic prestige deriving from it. When referring to team research, the focus is placed on developing a common theme, particularly for the purpose of bringing a specific topic on the academic and public agendas: *`we intend to work from small groups to larger groups and try to integrate everyone in these activities to highlight and promote the importance of a topic` (I9).* Also, the development of research teams can help create an *`ethos which can be shaped only through joint projects that focus on initiative, partnership and involvement` (I12),* thus contributing to the overall restructuring of the university and research culture. This last statement, which comes to support the importance of developing research teams, is closely related to institutional accountability to promote and support a standard of quality, performance and compliance codes and rules related to research ethics.

3.3. Internal strategies to promote and stimulate research production

Following the results of our research, the internal strategies that emerge when it comes to the promotion of research activities could be divided into three main categories:

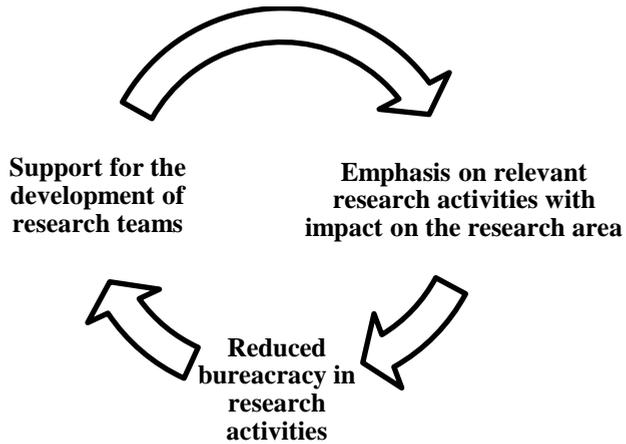


Figure 1. Internal strategies to promote and stimulate research production

When it comes to internal strategies for promoting research activities, the most important aspect is related to the necessity to develop relevant activities, with an impact on the research area, particularly the publication of articles indexed in the ISI Web of Science database:

‘the development of studies and articles published in indexed journals with impact factor is encouraged’ (I1).

Other strategies target the development of different events, such as the Research Excellency Gala, which have been developed throughout the Romanian universities aiming to bring researchers together. Also, academic managers present the importance of being part of a research team and of initiating partnerships with other national or international universities in order to develop joint projects. To do so, the university must provide some guidelines or a research strategy clearly stating that interdisciplinary research teams are encouraged and that researchers are free to choose their affiliation to a research group/team, an action which should be supported by simplified procedures for establishing new research centres within the university departments. Last but not least, academic managers involved in research activities agree that the most important strategy would be the reduction of bureaucracy when it comes to creating a new research centres or to developing research projects, which are generally associated with *‘administrative aspects that, in the majority of cases, overwhelm the researchers’* (I2). All in all, academic managers acknowledge the need for a more structured institutional framework and support, while maintaining autonomy in pursuing their research interests.

4. Conclusions

The academic managers' perspective on Romanian universities is defined by the universities' shift from the traditional model towards a more entrepreneurial university, as there is an increased awareness of the fact that teaching is not the sole component of a highly qualitative system. Therefore, more investments should be targeted at research activities in order to support future scientific and societal development and the general funding scheme for universities could also be altered to reflect this approach. Also, investing in becoming an entrepreneurial university is, according to Guerrero & Urbano (2012), the main element that differentiates one university from another, and this distinction arises from institutional arrangements, traditions and characteristics unique to each organization.

Even though the desire to move towards an entrepreneurial university by engaging in research activities becomes more obvious, there are still some challenges to be tackled along the way. One of these challenges refers to the necessity of developing relevant research activities with a real impact on the research area by publishing articles indexed in the ISI Web of Science database. Academic managers participating in the study perceive a higher pressure to publish more, doubled by a sense of urgency, which leads to negative effects including heightened stress levels, the marginalization of teaching, and research that may lack relevance, creativity, and innovation (Miller et al., 2011). This state of affairs is encouraged by the current evaluation system of academics in higher education, which emphasises the research component in the detriment of teaching, whereas the reality in the field mirrors a different image. This contradiction between the split roles of teaching and research in higher education could sometimes lead to research or publishing becoming a purpose in itself, beyond a scientifically-driven initiative that would bring added value both to the area of research and to society at large.

Another challenge is related to the bureaucratic burden attached to conducting research activities. A study shows that 35% of researchers in Romania consider that bureaucracy in their institutions is preventing them from operating under normal conditions, while 30% believe that government helps them (Florian, 2006). Academic managers advocate for a more structured framework and for more institutional support, while supporting the researchers' autonomy in pursuing specific research interests, thus contributing to an increase in their personal motivation to pursue more relevant results for the research area, for the higher education institution and its research community, as well as for the society.

In order to overcome these challenges, universities must develop internal strategies that lead to the development of a clear research vision and strategy within universities, which can help academics and researchers to further engage in individual or team research. Whereas academic managers have a central role in ensuring the institutional framework,

these strategies should be doubled by coherent policies regarding quality assurance, academics' evaluation and university ranking criteria, simplified bureaucratic requirements, as well as a renewed funding strategy for universities and research.

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Differences in Research Literacy in Educational Science Depending on Study Program and University

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Abstract

The ability to purposefully access, reflect on, and use evidence from educational research (Educational Research Literacy, ERL) are key competencies of future professionals in educational practice. Based on the conceptual framework presented in this paper, a test instrument was developed to assess ERL, consisting of the competence facets Information Literacy, Statistical Literacy, and Evidence-based Reasoning. This contribution aims to delve deeper into the question of whether Educational Science students differ in their overall ERL proficiency depending on their study program and university. This comparison is based on a large-scale study of 1,213 Educational Science students (Teacher Training and Educational Studies) at six German universities in the winter semester of 2012/13 and in the summer semester of 2013. The results indicate that students seem to profit from their studies at the different universities. Moreover, the ERL competence facets differentiate to some extent between universities and degree programs, which can serve as the starting point for curricular quality development measures. Subsequently, the results are critically discussed, and the desiderata for future research are stated, e.g., the identification of predictors that cause the reported differences.

Keywords: *Educational Research Literacy; Educational Science; higher education research; competency tests.*

1. Introduction

Due to continuous scientific progress, the modern knowledge society is constantly changing (Grundmann & Stehr, 2012); hence, the ability to purposefully access, comprehend, and reflect on scientific information, as well as to apply resulting conclusions to problems, is important for social participation. When making educational decisions, this ability is referred to as Educational Research Literacy (ERL; cf., Shank & Brown, 2007). However, the ability to reflect on and use evidence is neither necessarily developed nor retrieved in an optimal manner in adulthood (Barchfeld & Sodian, 2009). As students, graduates, and professionals in Educational Science will soon be responsible for imparting relevant competencies to future generations, education and the systematic fostering of research competencies will play a central role. Future educators have to be trained to critically reflect on and use research knowledge in practice. Higher education institutions are particularly suitable for this because they provide research-based education. Therefore, research literacy is not only included in the general definition of the standards and objectives for higher education degrees (Standing Conference, 2005), but it is also formulated as a requirement for specific study programs in the field of Educational Science. In German higher education, Educational Science is used as an umbrella term for different study programs that address both the theory and practice of education and training. A typical study program in this field is *Teacher Training*, which aims to convey competencies in Educational Science, and it also features a strong practice orientation in subject-related studies and didactics. Since Teacher Training is federally organized, the nationwide Standards for Teacher Training in the Educational Sciences (Standing Conference, 2004) exist and include various requirements, amongst others, the demand that teachers should be able to engage themselves with, and reflect on and use, evidence from educational research in their work. Another frequently studied degree program is Educational Studies¹, in which education and training over the entire life span are covered both theoretically and empirically. In contrast to Teacher Training, the Educational Studies curricula vary considerably between higher education institutions; topics range from primary education, media education, and cultural education, to adult education and vocational training.

Traditionally, German higher education institutions offer one-tier study programs that lead to Diplomas or Magister Artium degrees, or they were completed, such as in the case of Teacher Training, by the so-called State Examination². However, following the Bologna Reform agreement of 1999, Germany has committed itself to switching over to the Bachelor and Master's degree system by 2020; this process was nearly complete as of 2011

¹ German: Erziehungswissenschaft.

² German: Staatsexamen.

(Federal Ministry of Education and Research, 2015). Conversely, in Teacher Training, only 11 of the 16 German federal states have implemented the two-tier degree system as of 2015 (Standing Conference, 2015). Blömeke and Zlatkin-Troitschanskaia (2013) emphasize that the ongoing reorganization and change processes that are currently underway in the heterogeneous tertiary sector in Germany require a theoretical and empirical foundation to both develop and implement sustainable measures of quality assurance and development. The investigation presented in this paper draws on this point by validating an instrument that measures ERL in higher education, and which is intended for assessment and evaluation purposes at the student, course, or institutional level.

2. Conceptual Framework

The core component of the conceptual framework of ERL is the so-called research cycle, which is described in theoretical (e.g., Pedaste et al., 2015) and curricular models (e.g., Mandinach & Gummer, 2016). Evidence on the various facets of ERL, which correspond to the various steps of the research cycle, can be found in educational research and adjacent fields. For example, the ability to formulate appropriate questions and to search for and evaluate information is usually investigated under the concept of *Information Literacy* (IL) in information science (Blixrud, 2003). The ability to read and organize data, as well as to interact with numerical information, is referred to as *Statistical Literacy* (SL) in mathematics education (Groth, 2007). Numerous approaches that investigate the ability to systematically analyze evidence and to critically evaluate given conclusions (ER, or *Evidence-based Reasoning*) is addressed in Science Literacy (Brown, Furtak, Timms, Nagashima, & Wilson, 2010) and Critical Thinking research (Dunn, Halonen, & Smith, 2008). Furthermore, Groß Ophoff, Wolf, Schladitz, and Wirtz (accepted) present evidence to support the idea that one dominant factor that represents ERL in general can be distinguished from three secondary factors (IL, SL, and ER), which represent the particular requirements of various research steps.

However, whether such an assessment tool can differentiate between university-based and study programs remains open to debate, as this can be interpreted as an indicator of construct validity. Therefore, this paper addresses the question of whether Educational Science students differ in terms of their overall ERL proficiency, depending on their respective study programs and attended universities.

3. Methodology

The conceptual framework was used to develop a test instrument to assess ERL in higher education. To optimize the content validity of early drafts of this instrument, educational research experts (at the post-doctoral level or higher) reviewed the material. After the final revisions were made, more than 200 test items were available, each operationalizing one of the three competence facets (IL, SL, and ER). Due to assumptions of multi-dimensionality, and given the desired level of scale reliability, an incomplete block design was used in the standardization study to minimize participant strain (e.g., fatigue, motivation). To ensure standardized implementation, test administrators conducted the tests. During the test implementation phase, 40 minutes were allotted for test completion.

Table 1. Number of enrolled students in the winter semester of 2012/13, as well as the sample sizes of the Teacher Training and Educational Studies students at participating German universities.

University code	German federal state	Number of enrolled students:			
		winter semester 2012/13	n (TT)	n (ES)	
BW1	Baden-Wuerttemberg	4,493	354	192	
BW2	Baden-Wuerttemberg	24,074	144	59	
RP3	Rhineland-Palatinate	14,133	174	26	
LS4	Lower Saxony	26,300	32		
BE5	Berlin	34,898		68	
NW6	North Rhine-Westphalia	39,237	135	23	
total			839	368	

Note. N total = 1,213 students (Teacher Training and Educational Studies). Abbreviations: TT = Teacher Training; ES = Educational Studies.

The standardization study was conducted in the winter semester of 2012/2013, as well as in the summer semester of 2013 at six German universities (see Table 1). All of these higher education institutions offer study programs in Educational Science, and they particularly focus on Teacher Training and Educational Studies. The largest subsample originates from the smallest university (BW1). This institution is one of six Universities of Education (German: Pädagogische Hochschule) that emerged from teacher education academies approximately 50 years ago and developed into specialized Institutions for higher education in the federal state of Baden-Wuerttemberg. In other federal states, such as in the cases of RP3 and NW6, these teacher education institutions were integrated into the Educational

Science departments of state universities by the 1970s at the latest. Similar to BW1, RP3 is a rather small university that places a strong focus on Educational Science and related disciplines, as well as on subject-related didactics. Together with BW2, LS4, and BE5, NW6 is one of the largest universities in Germany, and it offers a wide range of study programs characterized by a strong research orientation. In Teacher Training, these comprehensive universities typically tend to focus on subject-related studies.

For this study, participants were recruited through participation requests that were made during lectures; participation was entirely voluntary and anonymous. The largest group of respondents is represented by 841 Teacher Training students, followed by 372 Educational Studies students. The samples of students from other study programs (e.g., Health Education and Educational Psychology) were considerably less frequently represented and were not considered further in this paper. A total of 74 percent of the total sample ($N = 1,213$) was comprised of female students with an average age of $M = 23$ years ($SD = 3.40$) and an average university entrance qualification grade (Abitur³) of $M = 2.4$ ($SD = 0.56$). At the time of the study, universities RP3, LS4, BE5, and NS6 had already implemented the Bachelor and Master's degree system, even in Teacher Training. Only those universities in Baden-Wuerttemberg (BW1, BW2) still carried out state examinations in Teacher Training programs at this time. The majority of the participating students were at the bachelor level (or at an early level) in their studies (number of semesters: $M = 3.4$; $SD = 2.3$). The only exception was LS4, where only one master's-level course in Teacher Training could be accessed (number of semesters: $M = 3.0$; $SD = 3.1$); these students were approximately six semesters ahead of the other study participants.

4. Results

Multidimensional latent regression models were analyzed using the R package Test Analysis Modules (TAM; Kiefer, Robitzsch, & Wu, 2016) to compare cross-sectional differences in the study programs at the different higher education institutions (see Table 1). Following the recommendations of Rose, von Davier, and Xu (2010), all omissions were treated as missing observations. Due to poor item fit ($0.80 \geq \text{Infit/Outfit} \geq 1.20$; cf. Adams, 2002), 33 items had to be excluded from the current analysis. Therefore, the results are based on 193 tasks (IL: 16%; SL: 37%; ER: 47%). The analysis draws on the comparison of the one-dimensional and multidimensional competence models reported by Groß Ophoff et al. (accepted). Depending on the focus of the analysis, either a unidimensional model or a three-dimensional model may be applied: Given that the general factor of ERL is dominant

³ German university entrance qualification; grades range from 1 to 6 (4 is the lowest passing grade), with lower numbers indicating better results.

over the secondary factors, a one-dimensional model is feasible for assessing, and providing feedback on, learning gains at the student level. For the purposes of course or study program development, it is also acceptable to distinguish between the three ERL subdimensions, IL, SL, and ER. For the current sample of Teacher Training and Educational Studies students, the one-dimensional model (M1: AIC = 38,852; BIC = 39,892; CAIC = 40,096) appears to exhibit a slightly better fit when compared with the three-dimensional model (M3: AIC = 38,858; BIC = 40,025; CAIC = 40,254).

Table 2. Results of the multidimensional latent regression analyses for the comparison of two study programs (Teacher Training and Educational Studies) at six German universities.

			M1	M3		
		% sample	b (G)	b (IL)	b (SL)	b (ER)
Teacher Training	BW1	29%	.39*	.36*	.43*	.37*
	BW2	12%	.61*	.73*	.77*	.42*
	RP3	14%	.23*	.24*	.37*	.08*
	LS4	3%	.82*	.86*	.84*	.71*
	NW6	11%	.48*	.60*	.51*	.40*
Educational Studies	BW1	16%	.43*	.57*	.40*	.41*
	BW2	5%	.40*	.45*	.41*	.35*
	RP3	2%	.08	.05	.07	.07
	BE5	6%	.41*	.33*	.55*	.33*
	NW6	2%	.20*	-.05	.21*	.29*
R^2			6%	-8%	14%	1%

Note. N total = 1,213 students (Teacher Training and Educational Studies). Abbreviations: M1 = one-dimensional model; M3 = three-dimensional model; b = regression coefficient; G = General factor one-dimensional ERL-model; IL = Information Literacy; SL = Statistical Literacy; ER = Evidence-based Reasoning; R^2 = coefficient of determination. * Significant regression coefficients ($p < .05$; two-tailed tests).

The results for both models are reported in Table 2. The grouping variable (Study Program*University) was dummy coded, so that the regression coefficients represent the estimated difference between group means. The positive regression coefficients indicate that students in both study programs seem to profit from their studies at the different universities. The universities BW2 and LS4 seem especially strong in supporting ERL. However, while the Teacher Training students at LS4 were at the master’s level, students at BW2 were at the bachelor level. As such, these results serve as an indicator of Teacher

Training quality in ERL at the latter university. Students at RP3 showed the lowest (and for Educational Studies non-significant) regression coefficients. With respect to Teacher Training, this can be explained by the fact that ERL was not an explicitly stated study objective in the curriculum at that time. Somewhat surprising is the overall result whereby Teacher Training students show higher proficiency in ERL than Educational Studies students. One possible explanation for this is that the latter study program features a stronger qualitative research methodology orientation, which is somewhat contrary in nature to the quantitative focus of the test instrument described here.

With regard to the three-dimensional model, the various competence facets of ERL are somewhat able to differentiate between university and degree programs, despite the high intercorrelations of the subdimensions ($r \geq .46$). For example, at universities BW2, RP3, and NW6, Teacher Training students showed lower ER proficiency when compared to their performance on the other two competence facets. Despite the overall competency differences between these universities, a similar trend was observed, insofar as performance on this facet of ERL was weakest. In another example, the rather small group of Educational Studies students at NW6 performed comparatively low in terms of IL; however, the negative determination coefficient indicates that the predictors did not contribute to the incremental validity of IL.

5. Conclusions

A reliable and economical test instrument was developed that is appropriate for verifying the significant and empirically plausible differences between study programs at different universities. The ERL model was proven to be valid, especially based on a one-dimensional model. However, the multidimensional model was also found to be substantial when assessing the competence facets SL and ER. Conversely, the differentiation between higher education institution and study program did not contribute to explaining variance of the competence facet IL. The strength of the presented research lies in the sample size and in the investigation of several universities from various German federal states. However, one must exercise caution when making inferences about institutional or curricular differences due to the non-representative sample included herein. Nonetheless, the results indicate that there are considerable differences in ERL between institutions and study programs. The results of another study, which compared the research competencies of German and Austrian Teacher Training students, further support this conclusion (Groß Ophoff, Haberfellner, Schladitz, & Wirtz, 2017). Thus, the assessment of ERL can serve as the starting point for curricular quality development measures, such as offering courses that address the entire competence spectrum (e.g., based on the Article Literacy Checklist; cf. Shank & Brown, 2007). This is further reinforced by the fact that less proficient students

are quite able to find and reproduce research information in tables, diagrams, and summaries, whereas only advanced students are proficient in evaluating scientific evidence and in critically appraising research-related conclusions (Groß Ophoff, Schladitz, Lohrmann, & Wirtz, 2014). To increase research competencies, it is also critical to foster self-efficacy in research, as well as to offer active participant learning opportunities throughout the course of study (e.g., Bell, 2016; Butcher & Maunder, 2014).

Given that the research presented in this paper follows the research cycle as well, the results necessarily raise new questions: Which predictors (e.g., institution-specific or course-specific learning opportunities) produce the reported differences? Is it possible to identify critical proficiency levels? How can the development of different facets of ERL be reliably assessed and fostered, particularly at the curricular/institutional level? These (and other) questions need to be addressed in further research.

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Conceptualizing a Theoretical Framework: Embodied Narrative Knowing

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Abstract

The dominant Western epistemological and ontological perspective marginalizes “other ways of knowing” (Taylor, 1997) that adult learners use to make meaning of their experiences (Crossley, 2007; and Michelson, 1998). Other ways of knowing have also been called non-Western perspectives and are defined as having their “roots in cultures and...traditions that pre-date Western colonization, modernization, and Western-driven globalization (Merriam, 2007, p. 173). The aim of this work is to explore support for a theoretical framework, informed by three established paradigms, to conceptualize non-Western and other ways of knowing. This work outlines the three paradigms that are utilized: Social Constructivism, Embodied Knowing, and Narrative Knowing. This work re-presents an experience of an adult learner who practices the martial arts (a traditionally non-Western practice) in order to offer preliminary validation and show a need for embodied narrative knowing as a theoretical framework for understanding non-Western ways of knowing.

Keywords: Embodiment; Narrative; Martial Arts; Non-Western

1. Introduction

As adults, how do we learn? In the West, learning is often perceived as being acquired through formal schooling methods, in which knowledge is validated through rigorous scientific research and empirical evidence (Merriam & Associates, 2007). This Western paradigm is largely influenced by Cartesian dualism, which promotes a mind/body separation, and values the cognitive and rational mind above all else (Merriam & Associates, 2007; Michelson, 1998). Dominant Western perspectives marginalize “other ways of knowing” (Taylor, 1997) that adult learners use to make meaning of their experiences (Crossley, 2007; and Michelson, 1998). Other ways of knowing that have been conceptualized in literature are: creativity, intuition, empathy, emotion, affective learning, the guiding force of feelings, spiritual dimensions, relationships, role of context, somatic, whole person and embodiment (Taylor, 1997).

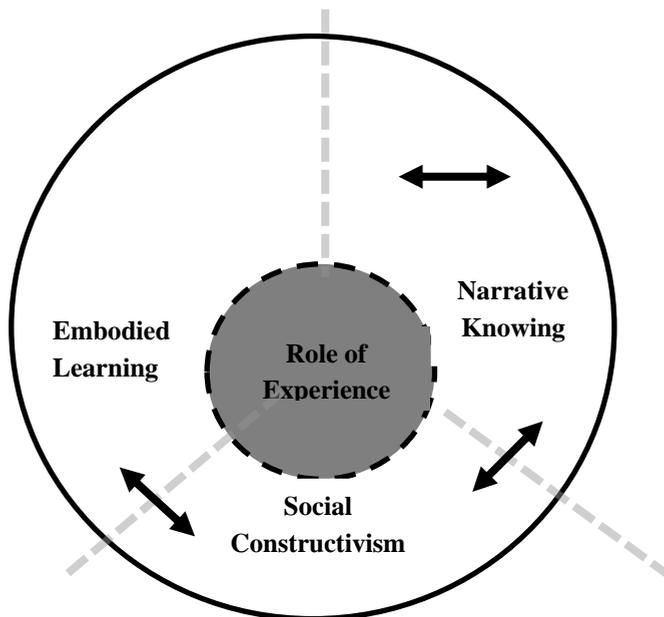
In the modern era the field of Western adult education has been shifting toward a global focus, retraining adult learners and educating for global competencies (Merriam & Brockett, 2007). In order to facilitate this new direction in adult learning and education strategies, an understanding of non-Western perspectives on the foundations of adult learning and education within the ever expanding global community is needed (Merriam, 2007). Non-Western perspectives are defined as having their "roots in cultures and...traditions that pre-date Western colonization, modernization, and Western-driven globalization (Merriam, 2007, p. 173). In higher education settings the need to reach a more diverse student population is more present than ever. With the increase of international students in the higher education landscape and the shrinking of global distances, through such tools as the internet, a one-size-fits-all model of education favored as a dominant standard in Western higher education is no longer adequate to meet the needs of these students.

As of this writing there is no theoretical framework readily available to Western audiences to assist in the understanding and framing of non-Western ways of knowing as a whole. This article proposes a theoretical framework, embodied narrative knowing, that is designed to address this deficiency. This framework is informed by three established paradigms which are integrated to create this framework: 1) Embodiment (Brown & Johnson, 2000; and Freiler, 2008); 2) Social constructivism (Berger & Luckmann, 1966; and Merriam & Brockett, 2007); and 3) Narrative knowing (Clandinin & Connelly, 2000; and Polkinghorne, 1995). This article will unpack the three paradigms and show how they are able to integrate into one theoretical framework. A brief example from a transcript collected through work from the author’s dissertation will illustrate how the practice of a non-Western way of knowing (i.e., martial arts) supports the need for this theoretical framework.

2. Need for a Framework

The need for a theoretical framework to specifically address a non-Western way of knowing stems from a lack of understanding, in Western hegemonic practices, of other ways of knowing. Gut feelings, intuition, instinct, and wisdom are all considered other ways of knowing and have been explored by researchers as individual constructs in relation to the meaning making process (Taylor, 1997, and Merriam, 2007). However, no theoretical framework exists, that allows other ways of knowing to remain a central focus of study, or allows for a better understanding by Western audiences. Instead other ways of knowing are being subsumed under pre-established frameworks, such as Transformative Learning theory (Taylor, 1997) and others.

The rationale for choosing the three paradigms to support this framework stem from the different ways that each paradigm interact and support each other in building a foundation to explore other ways of knowing. Specifically, the key component that each of these paradigms shares in the role of experience as central to their ontological and epistemological understandings of truth and the nature of reality. Each of these paradigms are discussed and a visual model has been provided to assist in the understanding of this theoretical framework in figure 1.



3. Embodiment

Embodied learning and knowing incorporates the mind, body, and spirit into the meaning making process (Brown & Johnson, 2000). This other way of knowing (Taylor, 1997) challenges the dominant hegemony of Western ontological and epistemological perspectives of how we come to be and make meaning of our experiences. There are two parts of embodiment that need to be unpacked for this model. The first is somatic learning and the second is embodied learning and knowing.

3.1. Somatic Learning

The most comprehensive conceptualization of somatic learning comes from Amann (2003). Amann (2003) conceptualizes the movement of the body as requiring four distinct contextual interactions to be involved in the meaning making process: kinesthetic learning, sensory learning, affective learning, and spiritual learning. Amann (2003) conceptualizes kinesthetic learning “as a result of the concerted movements of muscles, tendons, and joints” (Amann, 2003, p. 3). The acts of walking, running, jumping, or throwing illustrates the mode of kinesthetic learning that comprises Amann’s definition of somatic learning.

The second interaction of the body Amann recognizes is sensory learning. Sensory learning utilizes our five senses for the construction of knowledge in the meaning making process (Amann, 2003). The five senses of sight, smell, hearing, taste, and touch, work in conjunction to define how our bodies make meaning through a somatic lens.

Affective learning is the third interactional factor believed to be “the acquisition of knowledge as a result of paying attention to and honoring our feelings and emotions” (p. 4). The colloquial expression of a “gut feeling” may be the simplest way to understand this type of learning. Affective learning encompasses the concept of self-awareness which requires the recognition of the impact of emotions on our lives (Amann, 2003).

Finally, spiritual learning integrates the three other concepts into a holistic model for learning. Amann (2003) believes that spiritual learning is “about making meaning of our lives” (p. 4) through the construction of knowledge carried out through symbolic gestures such as art, music, rituals, and movements that have particular meanings (Amann, 2003).

Amann’s (2003) model “posits that meaning making is created by the body through movement” (p. 5) within each of the learning types. This model of somatic ways of knowing focuses on a different type of learning experience, one that engages the whole person in the learning process.

3.2. Embodied Learning

The second term to tackle is embodied learning, also called embodied knowing or embodiment. Ghane and Sweeny (2013) address the term of embodiment as a catchall for theories and studies that are informed by “basic principles of embodied cognition” (Ghane & Sweeny, 2013, p. 161). These principles hold that people “perceive their environment in terms of how they can physically interact and perform actions to manipulate objects that surround them” (Gibson & Walker, 1984 as cited in Ghane & Sweeny, 2013, p. 161). Thus, embodiment incorporates the behaviors of the mind and body through cognition, affect, and behavior as they interact with the environment.

Freiler (2008) addresses the distinction between somatics and embodiment by stating that they “are all closely aligned and used interchangeably” (Freiler, 2008, p. 39). A common thread that ties them together comes from Freiler’s (2008) review of literature in which embodied learning and somatic learning “are associated with an evolving awareness of bodily experiences as a source of constructing knowledge through engaged, lived body experiences of physicality, sensing, and being in both body and world” (p. 39).

Freiler (2008) makes a distinction that “somatic learning generally refers to learning directly experienced through bodily awareness and sensation during purposive body-centered movements” (p. 39). She goes on to state that “embodiment and embodied learning generally refer to a broader, more holistic view of constructing knowledge that engaged the body as a site of learning, usually in connection with other domains of knowing (for example, spiritual, affective, symbolic, cultural, rational)” (p. 39).

Freiler (2008) views embodiment as a way to conceptualize the construction of knowledge “by incorporating unity of mind and body in the process of knowing through both objective and subjective realms of knowledge construction” (p. 40). These two realms, objective and subjective, represent rational external knowledge construction and internal “personal ways” of knowledge construction respectively (Freiler, 2008). Important to both Amann (2003) and Freiler’s (2008) concepts are a unity of both mind and body, not a separation. Their models and concepts neither rank one above the other, instead they require a “remembering” (Michelson, 1998) of both in order to create a more holistic learning experience.

4. Social Constructivism

The constructivist paradigm is not a single unified paradigm, but a conglomeration of related ontological and epistemological perspectives that share an underlying commonality. This commonality “is the notion that reality can be known only subjectively...Knowledge is the meaning that people make out of their experiences” (Merriam & Brockett, 2007).

The multiple strands of the constructivist paradigm muddy the waters for beginning researchers wishing to rely on this approach. In order to establish a firm base to build this theoretical framework from, a re-tracing of the origins of the social constructivist paradigm is necessary. Flick (2014) and other authors of works on social constructivism cite Schutz (1962), Berger and Luckmann (1966), and Gergen (1995) as foundational for the tradition of social constructivism. Flick (2014), also states that these approaches emphasize “inquiries after the social conventions, perception, and knowledge in everyday life” (Flick, 2014, p. 76).

The conceptualization of social constructivism that informs this model relies primarily on the work of Berger and Luckmann (1966). Berger and Luckmann (1966) are sociologists who closely aligned with a sociological school of thought known as sociology of knowledge. This tradition draws heavily from sociologists such as Marx, Nietzsche, Shuler, Manheim, Durkheim, and Weber. Berger and Luckmann (1966) believe that “the sociology of knowledge, therefore, must concern itself with the social construction of reality” (p. 14). Their process recognizes a Marxian conception that “man’s consciousness is determined by his social being” (p. 5), and that human thought is founded in human activity (agency and action) and in the social relations brought about by this activity. This foundation illustrates that there is a relationship between human thought and underlying reality(s) that are manifested in other ways than cognition.

Berger and Luckmann (1966) integrate historicism into their process, to give an “overwhelming sense of the relativity of all perspectives on human events, that is, of the inevitable historicity of human thought” (p. 6). Simply put, all situations (e.g., experiences) can only be understood in their own terms or socio-historical contexts. This lead Berger and Luckmann (1966) to state that “society determines the presence...but not the nature...of ideas” (p. 7); which parallels work by Karl Manheim, that human thought is not immune to the influences of society and “knowledge must always be knowledge from a certain position” (p. 9).

Berger and Luckmann (1966) incorporate sociological perspectives from Schutz (1962) who is “concentrated on the structure of the commonsense world of everyday life” (Berger & Luckmann, 1966, p. 14). They draw inspiration from Durkheim and Weber defining everyday life as that which “presents itself as a reality interpreted by men and subjectively meaningful to them as a coherent world...It is a world that originates in their thoughts and actions, and is maintained as real by these” (p. 20). Berger and Luckmann (1966) define social construction as a “systematic theoretical reasoning” (p. 12), an “adequate understanding of the ‘reality *sui generis*’ of society [which] requires an inquiry into the manner in which this reality is constructed” (p. 16).

From the social constructivist paradigm, we come to know what is real through our shared interaction with the environment and the others who share that environment with us, at different moments in our time. Lincoln, Lynham, and Guba (2011) believe that “a goodly portion of social phenomena consists of the meaning-making activities of groups and individuals around those phenomena...it is the meaning-making, sense-making, attributional activities that shape action (or inaction)” (Lincoln, Lynham, and Guba, 2011, p. 116). Flick (2014) states that “knowledge is constructed in processes of social interchange; it is based on the role of language in such relationships; and, above all, it has social functions” (Flick, 2014, p. 78). In a social constructivist paradigm, the focus on language within social relationships and the experiences derived from these interactions is a crucial component of the theoretical framework.

5. Narrative Inquiry/Knowing

Narrative Inquiry is an increasingly popular methodology of qualitative research, and is acknowledged by a growing number of scholars in many diverse fields such as psychology, literature, anthropology, sociology, history, and education (Roberts & Shenhav, 2014).

5.1. Narrative Inquiry as Theory

As theory, Polkinghorne (1995) tells us that, “[N]arrative inquiry refers to a subset of qualitative research designs in which stories are used to describe human action” (Polkinghorne, 1995, p. 5). The terminology and meanings of narrative are diverse, and vary from one research project to another. A unique language emerges that narrative researchers rely on but do not always agree upon (Spector-Mersel, 2010). This unique language comes with baggage in the form of 2 concepts: (1) the interchangeability of story and narrative, and (2) the co-constructed nature of narratives.

Story. A unique element of narrative inquiry is the use of participant’s narratives or stories (Clandinin & Connelly, 2000; and Polkinghorne, 1995). Narrative Inquiry “is the understanding that narrative is a way of knowing” (Kramp, 2004, p. 106) and that this *knowing* is expressed in stories. According to Kramp (2004) “each story has a plot...reflects the perspective of the narrator...has a setting in time and place...has a beginning, middle, and ending, although not necessarily presented in that order as it is told” (Kramp, 2004, p. 109). Bruner (1996) states that, at minimum, a story has a character who acts to achieve a goal (plot) in a context by use of certain means.

Polkinghorne (1995) uses the term *story* to “signify narratives that combine a succession of incidents into a unified episode” (p. 7). Drawing primarily upon the linguistic research of Bruner, Ricoeur, and others, Polkinghorne (1995) establishes his definition of story, in which *plot* plays an integral part. Plot arranges the story into a narrative structure that: sets

a temporal range; criteria for selecting events to be included; temporally ordering the events; and making meaning of the events in relation to the story as a unified whole.

Clandinin and Connelly (2000) conceptualize stories as being within a “three-dimensional space”, which includes “*personal* and *social* (interaction); *past*, *present*, and *future* (continuity); combined with the notion of *place* (situation)” (Clandinin and Connelly, 2000, p. 50). This framework situates stories in time, paying attention to how this temporality affects the telling and retelling of the story. The three-dimensional space brings in the personal and social dimensions of stories and situates story, and telling of story, within specific places or sequences.

Co-construction. A story is co-constructed because there is a teller and a listener. Stories carry weight, are often purposeful, and convey meaning through the interaction of the teller and audience, or the co-constructed tellings and re-tellings (Clandinin & Connelly, 2000). “Narrative inquiry assumes ‘personal involvement’ as the very condition that makes it possible for you, as researcher to gather and interpret narratives” (Kramp, 2004, p. 114). Qualitative research requires the researcher to act as instrument for data collection, making personal involvement inescapable (Merriam, 1995). Instead of “dispassionately chronicling experience and events” (Kramp, 2004, p. 114), the co-construction of narratives brings the researcher into relationship with the story being co-constructed with the participant as insider and outsider.

6. Example

The example provided comes from an interview conducted by the author as requirement of completion for his dissertation.

“[B]alancing those three pieces you know, making sure that you know physically you work on it, mentally you prepare and then spiritually you invest in it. Putting those three pieces together is really important because that to me is what gives you the benefits beyond what happens you know for that one hour class. And then it’s taking that and living with it in that day to day. Using whatever you’ve learned to teach others and help other people out.”
(Interview Transcript from dissertation in progress)

This excerpt re-tells one participant’s philosophy of their practice of the martial arts. In this example the use of the embodied narrative knowing theoretical framework allows the participant’s entire story to be kept intact including the nature of interactions, interplay of mind and body, and the context and situatedness of his story. This allows for coding and analysis to take place that attends to the unique experiences of the participant as a whole rather than a part. Unlike another qualitative approach, such as phenomenology, the story is not distilled into its essence, but rather is kept whole for a more generalized

understanding. This approach allows for an greater understanding of the participant's narrative by those who do not share the same experiences.

7. Summary and Future Directions

The landscape in most Western universities is changing. There are continually more international students and with them comes a greater need for faculty to better understand the student's experiences and ways of understanding and coming to knowledge. The rational cognitive driven model of one-size-fits-all education is no longer enough and is being challenged by these student's experiences. Add to this the increased interconnectedness of the global community and the world shrinks at an alarming rate. A theoretical framework that can assist others in better understanding non-Western ways of knowing is needed. This need comes from a research perspective to expand horizons into relatively unexplored facets of knowing. It also comes from the practical side of teaching in higher education to better understand students and break free from traditional Western approaches, which leave some students behind.

Embodied narrative knowing is in its infancy and is by no means complete. The current work that it is implemented in deals with the experiences of advanced martial artists and is attempting to bring these non-Western and other ways of knowing to a Western academic audience. The field of martial arts research potentially challenges the dominant social structure in Western society, positing the experiences learned through the body (not just about the body) as equally important to the experiences reflected through the mind. Kleinman (2005) summarizes this shared responsibility for meaning making as "wholeness" (Kleinman, 2005, p. 258). This concept requires us to be aware of the imposition of categories of "appropriate states of being" (p. 258) that separate ourselves from ourselves, removing ourselves from being whole.

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Team-Based Learning in Chemistry Courses with Laboratory Sessions

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Abstract

The implementation of Team-Based Learning (TBL, <http://www.teambasedlearning.org>) in one-semester undergraduate courses of chemistry offered to first year students is reported. TBL is an active learning instructional strategy heavily relying on small group interaction. Teaching lab classes in a TBL context presented a specific challenge, as decisions were required about their role in the global framework and the possibility of incorporating lab activities as “teamwork”. The design of lab sessions as TBL team application activities is here also illustrated, both for a course of General Chemistry and a course of Organic Chemistry. TBL dramatically improved students class attendance and participation. Its implementation has provided a unique opportunity for the pedagogical development of teaching staff. A moderate number of students reported discomfort with TBL: the requirement of individual preparation before classes and the impact of team participation in the final grade is indeed a new ground for most students, often perceived as a troubling deviation from the common social paradigm of the learning process. The role of the instructor as a facilitator of individual and team work, and the clear explanation of the method are thus of utmost relevance.

Keywords: *Team-Based Learning; Chemistry; Laboratories; Flipped Classroom; Just-in-Time Teaching; Active Learning.*

1. Introduction

Pedagogical innovation is becoming a key aspect in assessing the quality of Universities (Abbott *et al.*, 2014) due to new requirements of labour markets, new sources of information for intellectual production and new possibilities for social participation. At the same time, insights about the neural processes of learning demand new strategies of teaching. Pedagogical innovation cannot simply aim at incremental improvements of traditional procedures with no questioning of the paradigms of teaching and learning. Evidence is now available that active learning can yield better educational results than the traditional method based on lectures (Freeman *et al.*, 2014; Waldrop, 2015). Organizational changes are demanded to improve science education with evidence-based teaching practices (Bradforth *et al.*, 2015).

Team Based Learning (TBL, <http://www.teambasedlearning.org>) is an active learning instructional strategy heavily relying on small group interaction (Michaelsen *et al.*, 2002; Michaelsen & Sweet, 2008). Most of class time is used for team activities consisting in the application of course content to solve problems. With TBL the student's role is completely changed: it now involves accountability for pre-class preparation, readiness for effective teamwork and peer evaluation.

A TBL course is organized in cycles (corresponding to content units) each one consisting in the Readiness Assurance Process (RAP) and Application Activities. The RAP follows a sequence of five steps: a) pre-class individual study, b) individual Readiness Assurance Test (iRAT), c) team Readiness Assurance Test (tRAT), d) written appeals and e) mini-lecture. Application activities follow, which are designed according to the “4S” rules: significant problems, specific choices, same problem for all teams and simultaneous report.

TBL has a history of more than 20 years (Haidet *et al.*, 2014) and has been used in a wide range of fields, including chemistry (Walters, 2012; Yasuhara *et al.*, 2013) – although not much has been reported concerning the incorporation of lab sessions in the TBL framework. In this article we communicate our experience in the implementation of undergraduate chemistry courses using the TBL methodology.

2. Implementation details

TBL has been implemented in one-semester undergraduate courses of chemistry offered to first year students: a General Chemistry course for engineering students (Mechanical, Physics, Industrial, Geological and Environmental Engineering) involving ca. 300 students/course, and an Organic Chemistry course for Applied Chemistry students with ca. 30 students. Students have generally no familiarity with TBL or other active learning

methodology. The number of faculty members involved in each course has varied between 2 and 4. None of them had previous experience with TBL.

The General Chemistry course has adopted TBL since 2011 and is here described in more detail. Lab sessions presented a specific challenge and were re-designed as team applications incorporated in the TBL framework. The courses typically encompass 14 weeks and are structured in five content units (cycles of 2-3 weeks). Each week has two class sessions of 2 and 3 hours.

Students are organized by the instructor in permanent teams of 5-7 members. Team formation aims at creating maximally diverse and balanced teams, based on students characteristics assessed via a Google form questionnaire (gender, main degree, previous chemistry courses, previous grades, and likelihood of attending all classes). Our specific implementation of the TBL routines are described below.

2.1. Pre-class individual preparation

Reading assignments and learning material are made available or listed through the campus Moodle platform (<http://moodle.org/>) and include a) book chapters (Chang, 2000; Clayden, 2012), b) videos of lectures (<http://ocw.mit.edu>), c) solved problems, d) on-line studying guides (<http://www.mhhe.com/physsci/chemistry/chang7>), e) mini-texts, and f) list of learning objectives.

2.2. iRAT (individual Readiness Assurance Test)

iRAT are simple multiple-choice tests focusing on the main concepts and their straightforward application. In some cases they are taken in class (and we use Remark software from Gravic, Inc. for automatic grading) but most often we rely on the Moodle system for remote testing previous to the first class of each cycle. Moodle tests have been configured so that students have a time limit of 20-30 min for the 10 multiple-choice tests, questions are randomly chosen from a data bank for each student and must be submitted sequentially, i.e. the answers to the first two questions must be submitted before the next two are displayed, and so on.

2.3. tRAT (team Readiness Assurance Test)

The same tests are taken by the teams immediately after the iRATs, or as the first activity of the cycle when iRATs are taken remotely. We use IF-AT answer sheets (<http://www.epsteineducation.com>) that are self-scoring and provide immediate feedback on each team answer. Answers are indicated by scratching the box corresponding to the chosen option – if this is the correct answer a mark is found. Appeals are allowed (and encouraged) when teams do not agree with the key in the answer sheet.

2.4. Mini-lecture

A 20-30 min mini-lecture caps the Readiness Assurance Process. It is usually based on the correction of the RAT tests, and specifically addresses questions arisen during the tRAT discussions. Depending on when and how RAT tests were taken, the mini-lecture may be shaped by the results, to focus on the most difficult issues – just-in-time teaching.

2.5. Application Activities

Application activities were designed or adapted to address the objectives of our courses under the TBL “4S” guidelines. At least one application per session is graded. In the General Chemistry course, beyond the problems requiring numerical calculations, problems were devised to deepen the understanding of concepts and foster discussions within teams. For example, in addition to pH calculations in acid-base equilibria, an application consists in the identification of the dominant species in each stage of a titration.

Typical applications in the Organic Chemistry course include mechanism-based explanation of observed phenomena, or finding the best reactants and other experimental conditions for the synthesis of a target molecule.

The simultaneous submission of answers by all teams for immediate inter-teams discussion (an “S” requirement) has been accomplished by different procedures. For example, in adapted versions of gallery walk, all teams simultaneously display their answers on the board or at walls. In another setup, answers are submitted via Moodle using students' smartphones and immediate display of aggregated results with a data show projector.

Laboratory sessions play an essential role in most chemistry courses, for the demonstration of chemical concepts, for the acquisition of lab work skills and scientific methods, or as exercises for the practical application of acquired knowledge. The TBL framework provides an opportunity to re-design lab sessions as active learning activities. We adapted old lab works to TBL applications, using essentially the same material and reagents. For example, a session dedicated to acid-base titrations was reshaped so that teams must find the concentration of an unknown acid solution using a strong base with known concentration. This team activity is graded based on the result – how close the reported concentration is to the real value. Because teams are typically larger than 5 students, the teams are divided in two: each sub-team validates the results of the other, and the whole team has to arrive at a final answer. Two other sessions (devoted to stoichiometry and chemical kinetics) are set up in the same way.

For a simulated lab application, we programmed a virtual lab of chemical kinetics mounted on a web site. It enables students to choose experimental conditions and to perform experiments (measuring concentrations at real time intervals). Students have to plan experiments, collect data, and use them to determine rate laws and activation energies.

In the Organic Chemistry course, lab works emphasize the development of individual lab skills and were also integrated as TBL activities. Teams are divided in pairs of students, and to each pair is assigned the synthesis of the same product. Teams have to deliver the maximum possible amount of bulk product (resulting from the contributions of all their students) with the highest possible purity. The team is evaluated on the basis of the amount and purity of the product they deliver. In this way, team members are encouraged to cooperate for the common goal of performing the synthesis in the best possible way. During the process, and at the end, the whole team has to decide which contributed products shall be excluded if their purity is not good enough.

2.6. Peer evaluation

Peer evaluation within teams reinforces student accountability to each other and is performed at two different moments, one at the middle of the semester (qualitative and with no impact on the final grade), and the other at the end of the semester (consisting in the distribution of points among teammates). The ipeer software (<http://ipeer.cltl.ubc.ca>) was installed in a University server and is used for all peer evaluations.

3. Assessment

A dramatic improvement in students class attendance and participation has been reported by all instructors. The results obtained in final exams are globally at least as good as with the traditional lecture system. Most instructors report a perception that less students are “left behind” in the first half of the semester. The TBL implementation has provided a unique opportunity for the pedagogical development of teaching staff.

In a 2012 survey among students of our first General Chemistry course implementing TBL, lab sessions (and solved problems) appeared at the top of the “activities/materials most useful for learning”. The percentage of students “agreeing” or “strongly agreeing” that TBL was more useful than the traditional system was 42%, and 57% considered peer evaluations “fair” or “very fair”. In a 2017 survey involving 148 students, 77% of students “agreed” or “strongly agreed” that they were better trained to work in teams than with the traditional method, 46% that they were better trained to study individually, 24% that they learned more, 41% that they were better trained to solve problems, 45% were more satisfied with the sessions, and 31% globally preferred TBL to the traditional system. These surveys, as well as informal perceptions, reveal some resistance from a moderate number of students to the new paradigm of learning and teaching.

Our findings are in line with trends observed in the TBL literature (Haidet *et al.*, 2014), namely a consistent greater participation in TBL-based classrooms, better or similar results

concerning knowledge acquisition (with students at the low end of the class usually benefitting the most), and some reports of lower student enjoyment or satisfaction.

The requirement of individual preparation before classes and the impact of team participation in the final grade is indeed a new ground for most students in our courses, often perceived as a troubling deviation from the common social paradigm of the learning process. The role of the instructor as a facilitator of individual and team work, and the clear explanation of the method are thus of utmost relevance.

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Aprendo Enseñando: Autonomy, Creativity, and Technology to Promote Mathematical Learning

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Abstract

This article shortly describes some of the basic characteristics, the theoretical support, and the general framework behind an activity developed for Precalculus students named “Aprendo enseñando” (translates I Learn by Teaching), a semester-long task proposed to students aiming to elicit higher retention and deeper understanding of the mathematical procedures involved in solving the problem sets assigned for each class. The activity is brought to students as the opportunity to combine their mathematical training in class and their autonomous choices for means to present fully explained solutions to peers, involving creativity in the use of the means and technology as a requirement for the final product to be shareable over the internet. Basic examples to explore different choices were provided, periodic submissions were required, and to enhance engagement, peer review via Blackboard (Learning Management System) forums was in place. No analysis of outcomes has been conducted yet, but a retrospective view and self-critique from the teacher's point of view is provided.

Keywords: *Mathematical understanding; communicating mathematics; student decision-making.*

1. Introduction

Brownell (1947) supported the use of *meaningful* or *significant* instruction in arithmetic for students, highlighting benefits such as increase in learning and retention, and improvements in their ability to avoid mistakes by perceiving them as anomalies. Almost thirty years later, Skemp (1976) spoke about the dual meaning of understanding in mathematics, contrasting on one side the purely algorithmic or, in his terms, *instrumental* mathematics taught by some teachers, and on the other side the *relational* mathematics, those built as a mind structure, logical and interconnected. It is not hard to see the correspondence—though not equivalence—between the meaningful learning of arithmetic and the relational mathematics; the same correspondence applies to their opposites, instrumental mathematics and *meaningless* arithmetic.

A clear picture of the way students are taught *instrumentally* is shown by Simon and Blume (1994) and Simon (1995) in reference to a teaching experiment where school teachers were the students and in their explanations they used memoristic arguments to support claims about area of rectangles. It is fair to expect for the students of those teachers to be taught exactly that way, to use memoristic arguments in support of their own mathematical claims; as their knowledge on the subject is built with the support of teachers not reaching understandings beyond those of repeating the formulas in a book, students will probably find it hard to go beyond those same formulas.

One of the main questions faced by an undergraduate-level mathematics professor is how to reach understanding when mathematics are presented in an instrumental way to students, especially in those courses where students are expected to already have the concepts and to be just warming up for more demanding subjects in their foreseeable learning path. It is not uncommon for such courses to have objectives related to meaningful learning and deep understanding, but those objectives are beyond the reach of the textbooks when the emphasis is placed on procedural fluency acquired by repetition. This is the case of the Precalculus courses using the activity described in this article, *Aprendo Enseñando* (AE for shortness), where the proposed activity is used as a way to elicit higher order learning in students.

2. The proposed activity - Aprendo Enseñando

AE was introduced at the beginning of the second semester of year 2016 (August – November) to the students of two Precalculus groups in one private university in Bogotá, Colombia. These students undertake Precalculus as a remedial course, understanding remedial as required for students failing to achieve passing scores on mathematics in at least one of two separate tests: first, before university application, the National Higher Education Access Test (known in Colombia as SABER 11); and after being accepted by the University the Mathematics Diagnostic Test, required by the university to those students not able to pass the requisite via their mathematics score in SABER 11.

There were 60 students (two groups of 30) at the beginning of the semester, one of them in Mathematics, two in other Sciences, twenty four in different branches of Engineering, and the others from other majors such as Economics, Business Administration, Law, Political Science, and Anthropology, just to mention some of them. Although those declared majors are to be seen just as descriptive data and not the basis for analysis—because it is not uncommon for students to register in a less entry-demanding major to transfer a few semesters later—it is important to have an idea of the expected need the students are going to have for further mathematics courses. These students faced the following challenge:

Given the day-by-day detailed schedule of the class, the topics and problems to be covered during each session, assemble groups from two to four students and choose weekly—on Friday—one of the problems reviewed during the week. This problem must be solved and carefully explained, and the solution and explanation must be presented in a format shareable via Internet and in a way that goes beyond still pictures and page scans.

Students were therefore required to assemble the groups and to choose the problem they were willing to attempt for the week, including autonomous decisions in the process; complete a solution for the problem, showing procedural fluency; add a full explanation for the procedure, involving some understanding and verbalization of the procedures required for the solution; and to share those pieces over the Internet using appealing formats, calling for the creativity and the use of technology.

Outcomes of the challenge were to be delivered to the teacher through the Learning Management System used by the institution, a rendition of standard Blackboard platform. A few times over the semester students were also expected to share over a forum just for their classmates and teacher, with the goal to get comments from peers and the teacher and for those comments to be available as a tool for everyone's learning.

2.1. Changes made for second use of the activity

After the first semester experience, the activity was set again as part of the grade for students enrolled in two Precalculus courses during the first academic semester of 2017 (January – May). Though some of the motivations will be discussed in deep in relevant places of the following sections of the paper, mentions of the most compelling arguments towards the changes are made here too.

Lack of feedback was one of the problems during the first semester of the activity, as the teacher's reflection shows. To address the issue, the first core change was the periodicity of the submissions. For the first semester submissions were expected weekly, but that was highly demanding both for students and for the teacher to grade. Opportunities for detailed feedback increased by spacing the submissions, from 15 total expected for the semester the number was dropped to 4, one before each of the quarter-term tests planned for the course. In that sense, as the academic term is about four months long, the new schedule fits the findings by Kuo and Simon (2009) keeping the idea of multiple assessments and adding stronger feedback.

Also in the search for better feedback opportunities, for the second semester of the trial run all submissions were to be made on the forum, open for classmates. As classmates were able to watch their peers' proposals and to learn from their submissions, they were also expected to provide feedback on, at least, two submissions other than their own. In the words of McKeachie and Svinicki (2013), "Providing feedback is more important than assigning a grade" (p. 83) and this move from closed to open submissions to the forums, increases the feedback received by the students on their submissions. Also, making submissions part of the study materials available for the class increases the bond between AE and the class as a community, appealing to the idea of *relatedness* as a driver for motivation, as theorized by Ryan and Deci (2000).

Another change was the hiring of a Teaching Assistant with the single task to provide help to students for the *Aprendo Enseñando* activity whenever they asked for it, and to comment on the submissions posted in the forums. The Teaching Assistant has no grade responsibility, the only goal of hiring one is to increase the amount and quality of the feedback received by students.

Finally, as the number of submissions was drastically reduced, the size of the groups was also reduced to increase students' participation in the different aspects of the activity. For the first semester groups of four students were both allowed and encouraged, with the aim to reduce the weekly workload, but for the second semester groups were restricted to two or three students hoping to get every student to actively work in each of the four submissions.

3. Theoretical Support

There are several theoretical reasons for the teacher to use this strategy to elicit understanding in students. A basic approach is based on Anderson's taxonomies for educational objectives, a revision of Bloom's taxonomy (Anderson & Krathwohl, 2001). As explained in short by Krathwohl (2002), Bloom's taxonomy was one dimensional and the new proposal revised that fact and turned to two dimensions, Knowledge and Cognitive Process; establishing a hierarchy in the Cognitive Process dimension. It is within the Cognitive Processes dimension that Apply, defined as "Carrying out or using a procedure in a given situation" (p. 215) is the third level, from low to high, just above Understand—somehow implying for this interpretation that understanding is a pre-requisite for application—but well below the top level, Create. In that sense, AE requires students to combine different cognitive processes, allowing for students to undertake tasks in levels other than application, including higher cognitive processes as creation in the development of appealing ways to communicate. Also, the peer-reviewing part of the activity calls for explicit use of Analyze and Evaluate, just in case those categories were not involved in deep in the choices made for the creation of their own submission.

From the mathematics education perspective, AE fits within some features of widely accepted theoretical frameworks on building understanding, though it was not created to match any of them. Just to begin mentioning some of them, going back to Brownell (1947), the teaching for procedural fluency fits mostly with *meaningless* teaching, with some lights of *meaning for* in terms of the procedures achieving meaning when students are able to overcome previous blockages, while the inclusion of AE provides the opportunity for the inclusion of *meaning for* as procedures are meaningful for their own explanation, and additional *meaning of* as the value of procedures and pre-requisites is highlighted in the construction of the explanation.

In the sense mentioned above, the relation of the procedures and the pre-requisites to create the explanation going beyond plain result, AE guides the students on crossing the line between *instrumental* and *relational* in the Skemp (1976) framework. As procedures are no longer limited by the instrumental perspective, their application needs to be seen in relation to the application of other procedures known before, and relation between concepts becomes relevant as students advance to complete the activity.

From Pirie and Kieren (1994), in their steps to build understanding, there is a quote supporting the implementation of activities involving verbalization of understanding, as AE hopes to be: "It seems that at both image having and property noticing levels the 'acting' notions are ephemeral and without the complementarity of 'expressing' do not remain with the student from one lesson to the next" (p. 180). As *image having* and *property noticing* are steps on the way for students to achieve a complete concept construction, the need of

‘expressing’ is immediately supported, and this kind of activities allow for students to communicate within their small groups and later with bigger communities, for example the community of classmates via the comments in the forums.

All of these seem to also fit the Learning Pyramid framework. The learning pyramid, with origins that are not perfectly clear, is commonly attributed to the NTL Institute for Applied Behavioral Science and this attribution is accepted even by the own institute (Polovina, 2011). Adaptations of the learning pyramid have been made in different contexts and even with different values for the percentages of learning and retention, being highly relevant here the one shared by The World Bank (n.d.), placing the retention rate—and therefore the learning—of teaching at the 90%, the highest of all the shown ones. Although the learning pyramid seems to lack the evidence needed to support the use of particular percentages and the implied comparison between ways to deal with the information acquired (Letrud & Hernes, 2016) the value of teaching as a tool for learning is supported beyond the pyramid framework, as evidence in Cortese (2005), Chase, Chin, Opezzo, and Schwartz (2009), or Nestojko, Bui, Kornell, and Bjork (2014) supports. Furthermore, there is a whole theory on learning by teaching, known as LdL for its German acronym, as presented by Grzega (2005, Sep). In mathematics, learning by teaching is common in teacher training, as presented in the book edited by Leikin and Zazkis (2010), and it is widely accepted in different contexts, as for example the highly regarded web community Art of Problem Solving (Ruszyk, 2009).

All these theoretical support for the content of the activity is accompanied by additional support on the means of the activity: autonomous selection on the way to deliver and the question to be solved are inspired on the short review of autonomy as a motivation driver by McKeachie and Svinicki (2013); technology as a motivator is inspired in Prensky (2001, October) and Handley (2014); involving creativity and hands-on work to increase motivation responds to the findings shown by Askill-Williams and Lawson (2001).

4. Shortcomings

Shortcomings on implementation are to be obtained through research on the outcomes, though none of said research has been done. However, there are caveats on the possible gains by students from the activity, especially taking into account the way students are tested in this kind of courses. It has to be acknowledged, for example, the general observation Nesher (1986) finds in any implementation of activities devoted to understanding beyond procedural fluency when students are to be tested on procedural fluency: “No one has succeeded in demonstrating that understanding improves algorithmic performance, though we all feel, intuitively, that this is the case, we are still in a state of wishful thinking without grounded facts” (p. 16). This means that, even if students are

gaining in understanding and ability to create conceptual relations in mathematics, as long as the testing is limited to procedural fluency, the students will not be able to see their effort as improved results in testing.

An expected shortcoming, already experienced during the first semester of application, though not measured, is the lack of critical reading by students when faced by an authoritative source. Finding a proposed solution for the problem online—it is possible to find solutions online to most of the course textbook exercises—and being confronted with the need to criticize and provide feedback for their peers are situations where students may see themselves as not having what is needed to question what is shown to them.

5. Personal Reflection from the Teacher

AE was a roller coaster of emotions during the semester. Problems in the implementation were found every week at the moment of submission, with students having trouble uploading some types of files, Blackboard limiting the size of the files they were able to upload, misunderstandings on the meaning of deadlines, failure to conceptualize the meaning of “going beyond mute slides’ presentations” and other ways to present the desired outcomes, and all other kinds of small trouble requiring quick fixes.

However, conversations with students at the end of the semester brought to the light two common themes: joy in making the submissions and disappointment in receiving few to none feedback. Adding the submissions, fourteen total, to a course schedule already including four quarter-term tests and ten in-class worksheets per group, with two groups running simultaneously, was too ambitious and backfired quickly. I tried to provide feedback for every group on those submissions exposed in the forums, and students were thankful for the comments received. This idea of providing feedback via forum, as seemed successful and was supported by students’ comments and theory, led to changes in the implementation for the second semester.

Students were also positive in their comments. On top of the already mentioned joy on the preparation, most of the students said it was nice to see their ideas going into practice. The possibility to explore presentation tools, including recordings of the traditional board-and-marker structure, different options and configurations in PowerPoint presentations, and web-based tools as Prezi or PowToon, was highlighted as valuable from their perspective. Also, opportunity to explore questions beyond reaching right answers, even in purely procedural questions as finding the quotient in polynomial division or adding rational expressions finding the least common denominator, showed them the value of meaningful learning and some of the conversations proved the issue to be clear for them too.

Changes have been made, not many but some, based mainly on the conversations with students at the end of the semester (as mentioned before, for the second semester of application once again two groups of 30 students each are undertaking the modified AE). Results are expected to be reported, at least to the level of personal analysis of informal conversations with students, by late-July 2017. Research results beyond self-report analysis are not expected soon, as the number of measured variables to compare between groups and with groups not using AE is restricted to one (each group gets different quarter-term tests, other groups not under treatment have other teachers and different tests, the only common test comes at the end of the semester). However, self-report may turn to be a highly reliable measure for motivation, and therefore on AE's impact on climate for learning.

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Developing speaking competences in technical English for Spanish civil engineering students

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Abstract

Traditionally, Spanish schools of civil engineering provide their students a class on “Technical English” in order to develop their language skills. However, this class does not cover all the skills that the student would need in the labor market and mainly focuses in the reading and writing skills, and in a lower degree in the speaking and listening ones. This paper proposes a series of innovative and informal training activities (cine-forum on technical civil engineering topics and role playing on real professional situations) that allow Spanish civil engineering students to develop English skills that can rarely be worked in the classroom (i.e. speaking, negotiating and conversing), encouraging debate, participation, and fostering their self-confidence to speak about technical-English topics in public. Although the students’ level of English is much lower than expected, they all agree on the importance of technical English for their future career. The results also show the students’ lack in skills that are difficult to train in regular classes (speaking and talking). Consequently, this situation would require to provide complementary activities like the ones suggested in this project in order to develop these skills and increase the students’ demand for engineering classes taught in English.

Keywords: English; language competences; speaking; civil engineers; UCLM.

1. Introduction

Although it has been common in Spain that undergraduates and graduates in science and engineering should study some classes and contents by reading textbooks in English, the Bachelor Degree in Civil Engineering at the University of Castilla-La Mancha (Spain) is completely taught in Spanish. In fact, the ratio of engineering classes taught in English by the Spanish universities is far from the ones of foreign universities as KTH in Sweden, Øsfold University in Norway, Aalto University in Finland, or Delft University in the Netherlands, where most of the classes are taught in English. In the last few years, the Bologna Process for higher education and the Spanish economic situation made Spanish universities to be concerned about the language competences in technical English for civil engineering students. Consequently, Spanish universities are adapting their study programs in order to make their students more competitive and ambitious with respect to their future careers in the current global world.

The scarce number of classes taught in English in the Spanish civil engineering degrees is based on different reasons: (1) Historical protectionism of Spanish in the Spanish society. (2) Low historical unemployment rate among Spanish civil engineering professionals that allowed them to develop their professional careers in Spain. (3) Lack of a clear strategy on teaching in a foreign language in Spanish civil engineering schools. In most cases, the offer has included only those classes suggested by the professors themselves, but the schools rarely stimulate them to do so by compensating the extra effort that involves the preparation. (4) Reticence of students to be evaluated in a foreign language, especially in technical degrees. In fact, traditionally, students preferred that the core classes were taught in Spanish, which in most cases limited teaching in English in the other non-core classes.

In general, current Spanish civil engineering students have studied English for at least 6 years at secondary school, and some of them for 12 years since primary school. They are even required to obtain a B1 level in order to graduate from their undergraduate studies and to access the graduate studies. However, some researches show that students graduate with a limited level of English (Collins *et al.*, 2000; Gömleksiz, 2007; Ward, 2009), and that much more has to be done if we are to debate, do business, or have a regular conversation/negotiation with them in this language.

The students' own perspective of their education is also changing radically, as they are becoming more aware of the importance of English in order to develop their professional career. In fact, the number of applications to participate in exchange programs with foreign institutions (i.e. ERASMUS, LEONARDO, SENECA, or IAESTE) increases yearly in practically all bachelor degrees. Yet a large number of these applications are dismissed at the receiving institutions because of the lack of the required level of English on the part of the applicants.

In this sense, some Spanish degrees in civil engineering (i.e. the polytechnic universities of Catalonia, Valencia, or Madrid) offer a class in “Technical English” where the student earns complementary English competences for their future professional profile. Some universities even require accrediting a B2 level to be able to enroll in this course, which, at the same time, is mandatory to graduate from the undergraduate program. This course usually develops students’ writing skills (they must learn technical vocabulary and write technical reports), listening skills (classes are given in English and technical videos in English are used as well), and reading skills (they read technical documents and reports). However, the class does not cover all the skills that the student would need in the labor market, since there is rarely enough time and means for students to practice the English speaking skills under the supervision of professors. Therefore, an English integral education is needed with training activities complementary to the Technical English course.

Three issues are raised in the case of the Technical English course. Firstly, the vocabulary of this class is out of context and it is taught all at once without being applied in the different areas of civil engineering. Secondly, the very limited length of the class (merely four months or 4.5/6 ECTS) does not guarantee that students learn the required minimum vocabulary to practice engineering. Thirdly, this class is usually conducted by language specialists and not by civil engineers that could be closer to the engineering needs in the professional sphere, not being able to design specific exercises focused to the students’ future professional requirements (Collins *et al.*, 2000).

Other strategies or experiences aiming at improving the English language proficiency for civil engineering students are hard to find, in spite of the above-mentioned importance of this skill. Some universities of English speaking countries offer specialized courses to help international students with technical engineering concepts in English, like the Imperial College¹ in the UK or the University of Adelaide² in Australia (Missingham, 2006). The Institution of Civil Engineers in the UK holds “Lunch and Learn webinars”³ of 30-45 minutes on current civil engineering topics, focused on “continuing professional development” for professionals; while the London School of Economics celebrates “Lunchtime Lectures”⁴ covering political, economic, financial, legal, and social issues. Brown University, in the US, offers weekly workshops and “brown bag” conversation “Seminars for English Language Learners”⁵ where student-selected news articles trigger

¹ <http://www.imperial.ac.uk/academic-english/undergraduate-and-exchange-students/>

² <https://www.adelaide.edu.au/course-outlines/104829/1/sem-1/>

³ <https://www.ice.org.uk/news/lunch-and-learn-webinars-to-aid-your-cpd>

⁴ <http://www.lse.ac.uk/europeanInstitute/events/BREXIT-Lunchtime-Lectures.aspx>

⁵ <https://www.brown.edu/academics/college/support/writing-center/english-second-language/english-language-learners>

discussions about US culture, idiomatic language, and vocabulary. These seminars are offered during lunchtime and food and refreshments are provided by the university.

Regarding regulated education in non-English speaking countries, some universities offer bilingual degrees in Civil Engineering, while some other offer intensive courses with lexical-semantic, syntactic, pragmatic and phonological contents. Generally, BSc civil engineering education in non-English speaking countries is mostly taught in the mother language. However, due to the necessity of improving the students English skills, some universities are inserting contents in a foreign language, mainly English (i.e. Politecnico di Torino, Italy) or even specific language education (i.e. École des Ponts ParisTech, France). Exceptions have been found in Eastern-European countries, where the study programme can be fully followed in English (i.e. Politehnica University of Bucharest or University of Warsaw).

A different scenario develops in MSc civil engineering education. The most representative universities in Sweden and Poland offer these studies totally in English. On the contrary, Spain, Italy, Germany, or France tend to maintain the mother language in most of their master programmes, although English has a higher presence than in their undergraduate studies, with percentages that can reach up to 30%. This fact highlights the need of a softer transition from an education in the mother tongue to an education in English, which in most of the cases takes place with the access to master studies.

The urgent internationalization of students and future professionals demanded by the current labor market has thus contributed to the increase in the students' willingness to study core classes in English in Spain. However, students still maintain a certain reluctance to enroll in an engineering class taught in English because it can become a challenging obstacle if they do not possess an adequate level of English. In addition, students find another drawback when facing extremely condensed engineering classes (due to the degrees' homogenization by the Bologna Process) in a foreign language. This situation places the students in an important dilemma. On the one hand, they are aware of the importance of learning in English and want to make the effort to study the class in this language. On the other hand, they do not dare to take the class in English because they do not know if they will be able to follow it with their current knowledge of English.

Despite the great acceptance of this class by the students in their respective universities, the UCLM School of Civil Engineering does not have a "Technical English" class. This fact significantly disturbs the students' technical English education and makes them less competitive in the current labor market. Aware of this problem, and taking advantage of the effort being made by the Vice Chancellor of International Relations to internationalize the UCLM, the UCLM School of Civil Engineering has outlined a strategy to improve the competitiveness of our students at an international level. This strategy includes the

following actions: (1) to improve students' self-confidence so that they can successfully face classes and speaking in English; (2) to develop students' communicative skills in English (this is key to the School as it applies a project-based learning methodology); (3) to encourage critical thinking, discussion, and participation among students; (4) to increase the number of classes taught in English; and (5) to promote the creation of new ERASMUS agreements and double degrees with foreign universities.

2. “Lunch&Movies”, honing technical English skills of future civil engineers

The present teaching and learning experience is a first step to respond to the actions described above. The main objective of this project is to develop students' communicative skills (both listening and speaking) in English, encouraging discussion, participation and their confidence to speak English in public. The proposed innovative training activities have the purpose to reinforce the skills of all the subjects of the Civil Engineering educational program. For this reason, it is suggested an entertaining and fun learning method outside of the classroom and away from regular evaluation systems through voluntary training activities in sessions called “Lunch&Movies”. These sessions were accommodated throughout the 2015-2016 academic year (usually once every month) in agreement with the students' availability. The sessions can be classified in:

1. **Cine-Forum on Technical Civil Engineering topics.** This activity is developed in sessions during lunchtime with an average duration of 75 minutes and have two clearly differentiated parts. During the first half of the session, attendees watch a 20-to-40 min video on one of the main areas of civil engineering (urban planning, transportation, hydraulics, geotechnics, environment, technical drawing, and materials and structures) in English. Professors of the different areas are in charge of organizing each session and preparing a “viewing guide” with key technical vocabulary and related questions for debate. In the second half of the session, students are divided in groups of 3-4 people (with a similar level of English) led by one or two professors for debating about the viewed video. The groups, under the guidance of the assigned professor, first identify the meaning of different technical terms that appeared during the viewing, followed by a debate in English about some issues related to the video. At the end of each session, a representative from each group is responsible for presenting their main conclusions to the rest of the class.

2. **Role playing on real professional situations.** This activity is based on a “role play” game, a technique widely used in MBA studies. These sessions improve both the students’ empathy and their communicative skills in professional situations. During each session, and guided by professors as well, students are divided into groups of 3-4 people. Each member of these groups is assigned a different role of a hypothetical professional situation. For example, if a problem occurred during the construction process of the Panama Canal, the different roles of a group of 4 people could be: a member of the local administration, a member of the construction firm, a member of the protection agency of birds, and the investor.

In order to document the students’ learning process, sessions might be recorded and analyzed by professors afterwards. Then, students receive feedback on their speaking exercise as it is a key aspect if we are committed to improve student English skills (Kuhn and Vaught-Alexander, 1994; Berthouex, 1996). At the end of the academic year, the students complete an online survey about what they have learnt and about the usefulness of the sessions. This evaluation may also be supplemented with pre-and post-participation level tests so the groups are composed by professors and students with a similar level of English, regardless of the academic year they are in. In this sense, the project achieves three paramount objectives: first, students feel more comfortable and get over their shyness about speaking English in public; second, students from different years and studies (undergraduate and graduate) get to know each other; and third, it fosters collaboration between professors and students.

Before the project started, the students filled an online survey to assess their perception of the quantity and level of English taught at the UCLM School of Civil Engineering. In total, 135 students replied (85% of total), showing the high interest on this issue. Some of the results of the survey are the following:

- Students agreed on the importance of technical English for their future career.
- The students’ level of English is far from that required by other Spanish schools of civil engineering: in average, B1 or lower; and B2 is only obtained by 11% of the students. The higher level is clearly attained in the Master degree, which is explained by the fact that a B1 certificate is required in the admission process.
- The majority of students (51%) would be able to understand less than half of an engineering class taught in English. In the master degree, this figure is of 80%.
- The main reason that leads students to choose classes in Spanish is “Fear of not being able to follow classes in English”, and not “Easiness of the class in Spanish”.

- The majority of students have a lack in skills that are difficult to train in regular classes (speaking and talking) and would require complementary activities in order to develop these skills. However, they feel more comfortable reading and writing.
- The majority of students (85%) would be willing to attend the lunchtime complementary activities proposed by this project.

This project aims to develop and hone different skills related with the learning and improvement of a foreign language for Spanish civil engineering students:

- To improve the ability of the students to understand the technical vocabulary of the main areas in civil engineering, as well as to develop advanced aspects in English. In spite of a general knowledge of the English language, the technical vocabulary and expressions will be essential in the students' future careers.
- To improve the students' ability to speak fluently in English, as well as, the ability to synthesize ideas and express them correctly.
- To improve the ability to negotiate in English. After finishing the Bachelor Degree in Civil Engineering, they will face situations in which they should be able to discuss and express their opinions correctly in English.
- To improve the students' ability to understand lectures and technical videos in English, not only contributing to learn technical English, but also to expand the knowledge related with the civil engineering environment.
- Finally, the students should have the ability to work abroad since the scope today of civil engineers is set worldwide (Gömleksiz, 2007).

3. Conclusions

This paper presents an innovative project seeking to strengthen Spanish civil engineers English skills through an informal way of learning. The project proposes optional training activities that allow students to develop skills that can rarely be worked in classrooms (i.e. speaking, negotiating and conversing in English), encouraging debate, participation and the confidence of students to speak in public. These activities have the purpose to reinforce the skills of all the subjects of the Civil Engineering educational program. In this sense, an entertaining and fun learning process outside the classroom and far from traditional evaluation systems is proposed through activities organized in two types of sessions.

First, cine-forum on technical civil engineering topics, where students watch a movie or a lecture on one of the main areas of civil engineering (urban planning, transportation, hydraulics, geotechnics, environment, technical drawing, and materials and structures) in English. After the viewing, students work in small inter-cohort groups composed by students from different courses and a guiding professor. These groups first identify the

meaning of different technical terms that appeared during the viewing, and subsequently debate in English on different questions related to the video. Second, role playing on real professional situations, where students train both their empathy and their communicative and negotiation skills. During each session students are also divided into groups guided by a professor, and each member is assigned a role of a hypothetical professional situation.

This teaching and learning experience aims at improving the students' speaking and communicative skills in English and thus increasing the students' self-confidence so they demand engineering classes in English. The project increases the technical vocabulary in English in the main areas of civil engineering and provides a broader engineering knowledge on concepts studied in the different classes. In addition, the students are also introduced to the use of audio-visual material for language learning, increasing their listening skills in English by being exposed to different accents that could be needed in their professional career when working with people of different nationalities (Dai and Goodrum, 2011). In this sense, the project encourage teamwork and trains the students' social skills for communication and searching of agreement, developing their critical thinking and healthy respect for different opinions. The project also improves the students' educational mobility in study abroad exchange programs, as international experience in engineering is warmly welcomed by current global engineering firms (Gömleksiz, 2007).

Finally, regarding the UCLM School of Civil Engineering, the project encourages collaboration between the different research areas, it helps attracting more international students and achieve new international exchange agreements with other institutions, making the UCLM Bachelor Degree in Civil Engineering much more attractive to future students.

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Postgraduates in education, exploring their sense and meaning of education

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Abstract

In this research, we present an analysis carried out in the city of Poza Rica, state of Veracruz, Mexico on the meaning and significance of education that students attribute to the master programs related to education. We base this work from the Theory of Social Representations of Serge Moscovici (1961) and the Method of Symbolic Interactionism of Herbert Blumer (1969), this research is consistent with the educational policies in the training of professionals, due that from an inductive study with a cualitative perspective, we can do an analysis with more relevance on the impact that the offer of postgraduate has on the training of current professionals. Two study contexts were taken: masters in education offered in the public sector and masters in education offered in the private sector. As well, the agencies that shape the policies for the evaluation of postgraduate programs in Mexico, particularly with emphasis on the National Council for Science and Technology(CONACyT for its acronym in Spanish) framework.

Keywords: *Educational policy, qualitative research, social representation, vocational training.*

1. Introduction

The postgraduate training in Mexico as a system has gone a long way, which has involved a willingness by the various institutions to lead to national agreements that regulate the system. The postgraduate training is part of an educational policy considered in each educational program of each six years-period of government to care for quality in the postgraduate. This has impacted both public and private universities.

It is necessary to mention that the researches that exist on the subject of the postgraduate in Mexico are usually of quantitative cut, Sánchez S. (2012) affirms that of the incipient studies that exist on the postgraduate, are simple statistics or diagnoses and do not approach the problem in depth. It is necessary to count on studies that allow us a deep, in situ knowledge of how the postgraduate course develops in the different contexts of Mexico. Therefore, we present at this moment, a study with a qualitative approach carried out in the City of Poza Rica, located north of Veracruz, Mexico. This study had among its purposes, to investigate and to know the sense and meaning of formation that the students attribute to their own studies of masters in education..

In order to begin this research, it was necessary to carry out a preliminary exploration in 2014 to know the masters related to education offered in the mentioned City, identifying what each of them offered as: scholarships, registration fees, Exam's days, facilities and finally their curriculum. We find that in Poza Rica, Veracruz, postgraduate programs in education are available in both public and private sectors, as shown below:

Master programs	Sector	Institution	PNPC (National Program of Quality Postgraduates)
Learning Management Máster, profesional orientation.	Public	Facultad de Pedagogía Universidad Veracruzana	In consolidation
Education Máster, profesional orientation.	Private	Universidad Huasteca Veracruzana	No
Education Máster with Specialty in didactic competences, profesional orientation.	Private	Instituto de Estudios Superiores en Educación	No
Science in Education Máster, profesional orientation.	Private	Universidad del Valle de Poza Rica	No
Educational Technology Máster, profesional orientation.	Private	Universidad del Golfo de México	No

Source: own elaboration.

The Masters chosen to develop the present investigation were:

Public Master's Degree:

- Management Learning Máster, Universidad Veracruzana.

Private Masters:

- Education Máster, Universidad de la Huasteca Veracruzana.
- Education Máster with Specialty in didactic competences, Instituto de Estudios Superiores en Educación
- Science in Education Máster, Universidad del Valle de Poza Rica

We observed that the largest offer is in the private sector, with just one master's degree program offered by a public school. What is the reason for this situation? From this research, we identify that masters in the private sector do not have a solid curricular design to offer a quality postgraduate, examining the marketing nature of the training. Moreno (2004) states that:

The quality of a Postgraduate in Education does not depend on the type of institution that offers it, the target population that attends or the educational function, but on a curriculum design with a good level of internal congruence, with achievable objectives and A form of operation fully consistent with its main purpose, in charge of consolidated academic plants and with support in a sufficient and up-to-date infrastructure (Moreno, 2004, p.3).

On this question, the study carried out by García (1995) is interesting, since he identified that in Mexico there are institutions with a solid postgraduate offer, differentiated from the offer of the degree programs, where the postgraduate degree is administered by a division, council or direction clearly identified within the organizational structure. In this sense, a better care is taken in the offer of postgraduate courses in public institutions than in private ones.

From our study, we observed that the in offer in the private sector, at least in the City of Poza Rica, Veracruz reigns the commercial character of the postgraduate, diminishing importance to the monitoring of educational policies, neglecting the true sense of formation in the context of the Master Degree, that according to the National Program of Quality Postgraduates (PNPC) of the National Council for Science and Technology (CONACyT) has two orientations: professional and research. The Universidad Veracruzana is the only school at the upper level of the public sector in the state of Veracruz. However, we must take into account that in a study carried out the indicators to evaluate the quality of postgraduates in Education, Cardoso and Cerecedo (2011) affirm that there are still few programs in education that actually meet the indicators of greater exigency that establishes the CONACyT, the reason is that the evaluation criteria are based mainly on the natural sciences, exact and engineering leaving aside the field of education.

2. Organizations that dictate educational policies on postgraduate education in Mexico

The development of the postgraduate course relies on the educational policies that are managed by various bodies or agencies that are located in the area of public administration, which are:

Secretariat of Public Education (SEP)

In 1921, by the initiative of José Vasconcelos, rector of the National University of Mexico (UNAM), the Secretariat of Public Education was created. On October 20, 1935, the organization created the drafting of curriculum projects, programs, regulations and in general the norms and dispositions necessary to regulate the work of the establishments of higher education in the country. Particularly in the area of postgraduate studies, the Undersecretariat for Higher Education has, through the Directorate of Higher Education for Education Professionals, a normative framework to "carry out actions aimed at proposing and evaluating policies regarding the authorization of postgraduate courses for teachers, taught by institutions of higher education" (p.1).

National Association of Universities and Institutions of Higher Education (ANUIES).

This body was created in 1950 and has participated in the formulation of programs, planes and national policies, as well as in the creation of organisms oriented to the development of Mexican higher education.

In Mexico, it is the National Council for Science and Technology (CONACYT) that, through the National Program of Quality Postgraduates (PNPC) and the Postgraduate Quality Promotion Program (PFCP), regulate the postgraduate offer through a series of evaluation criteria and quality standards. According to this organization, an accredited postgraduate program is located at one of the following levels:

- 1.- Recent creation: are the recent programs that meet the basic requirements as an academic plant, a curriculum, among others.
- 2.- In development: they are programs that have fixed and sustained their plan of improvement and the feasible goals to reach in the medium term. In addition, they have a teaching plant with high professional profiles.
- 3.- Consolidated: programs that have national recognition for the relevance and impact in the training of high-level human resources, academic productivity and collaboration with other sectors of society. All its academic plant counts on a high professional profile and belong to the National System of Investigators (SNI).
- 4.- And International level: they are programs that have collaborated with other programs through agreements that include the mobility of students and professors, the co-direction of thesis and projects of investigation as a whole.

The PNPC uses a qualitative-quantitative methodology in its evaluation processes, to assess the compliance with indicators that determine whether a postgraduate is a quality program or not. The fact that a postgraduate program is contemplated in the PNPC is a great recognition and a great advantage in comparison of the other institutions because it reflects the quality in which the institution is. The evaluation process is done by a peer committee who base their recommendations on:

- Self-evaluation of the program
- The fulfillment of the evaluation criteria and guidelines contained in the Framework of Reference for the Evaluation and Monitoring of Postgraduate Programs.
- The statistical information of the program.
- Means of verification.
- The interview with the Postgraduate Coordinator
- The file of the program and the observations that have received, if appropriate, previous evaluations.

These aspects are necessary, since they are accepted or not the programs give a reference of how is the operation of an institution. In addition, the Reference Framework for the Evaluation and Follow-up of Face-to-Face Graduate Programs, states that:

These programs have a thorough evaluation to certify and take care of the entry process, curricula, academic nucleus, infrastructure, entrance and exit profile, besides taking care of the profile of the teachers and that the Lines of Generation And Application of Knowledge (LGAC) are relevant to the area (Reference Framework for the Evaluation and Monitoring of Graduate Courses, 2015, p.10).

However, through our study we could realize that in Mexico, despite the educational policies that monitor the creation of quality postgraduate courses, there is the creation of masters and doctorates that arise without measure and not all have the requirements of Quality and social relevance, generating the diversification of studies of dubious origin and a commercialization in the training of the students.

3. Theory of Social Representations of Serge Moscovic

We base the study with the theory of social representations of Serge Moscovici (1979). For this author, "social representation is an organized corpus of knowledge and one of the psychic activities through which men make physical and social reality intelligible, are integrated into a group or a daily relationship of exchanges" (p. 18). On the other hand, social representations are an interpretation about our way of understanding, conceiving and interpreting with what we daily live, social representations start from the individual to the social, transmitted through communication and interaction with others . Social representation is related to how groups within society group and talk about how they perceive their reality within the context in which they are immersed, based on an action that can be: observable, rationalized and experienced.

4. Working Methodology

Our work was based on a qualitative approach, which gave us the philosophical foundations that allowed us to have the sensitivity of capturing both the characteristics of the educational reality and the essence from which our research subjects construct the meanings attributed to their formation, knowing In advance that to develop a research with a qualitative approach, it takes a dose of craftsmanship in its construction and an adventurous eye to capture with astonishment that which is in the immediate reality of the subjects. According to Taylor and Bogdan (1994), "qualitative methodology is a way of looking at the empirical world" (p.20).

4.1. The Method of Symbolic Interactionism

To give greater reliability to the study, we are based on the Symbolic Interactionism Method of Herbert Blumer (1969), which rests on three fundamental premises which are:

1. Human beings act on things based on the meanings they have for them.
2. The meanings of such things derive from the interaction that the person has with other human beings.
3. Meanings are handled or modified through an interpretive process that the person puts into play when he makes contact with things (p.65).

With these premises we can identify the process of construction of the meanings that guide the interaction of the subjects and their actions.

4.2. Study subjects and information retrieval techniques

For this research, our main study subjects were 2nd and 4th. semester students, as we consider they have a real knowledge of the training context that is provided in the postgraduate. The technique used to obtain the information was the interview. This technique gave us the opportunity to interact directly and in the real context with the study subjects. In this regard, observation was a valuable tool for looking at contexts in situ training.

5. Results

From the research we can say that: private institutions offer the postgraduate in accordance with the predominant interests of applicants: obtaining a degree and possession of a professional title. Although, having a postgraduate degree is a social representation that, in

addition to giving a status and recognition to a particular society, allows to raise the category of hiring and therefore improve the salary. In this regard, students who are trained in a context of particular mastery told us that the sense in which they entered the mastery was to obtain a degree that allowed them to move up and get a better salary. On the other hand, they also recognized that they needed to prepare themselves to be up to date, develop better strategies and knowledge in their work, as well as being critical and discovering new fields of research education.

The meanings built by the students on formation revolve around reflective, theoretical, permanent and innovative learning; For them training means learning for the working world, promoting reflection, creativity and practicality in their work.

Experience plays a fundamental role for the construction of meanings, in this sense, the experiences around postgraduate training for students began from the process of entry, incorporation and permanence where they have generated ups and downs, from stress For the hours between their jobs and the courses, to have the commitment to learn and to generate an intellectual and competent change.

Finally, regarding the type of training orientation, it is pertinent to mention that the students of the private masters did not have knowledge of the formative orientation of the masters, of their importance and professional impact that a postgraduate with recognition by the PNPC, or having teachers with a high professional profile. Masters that do not have a recognition within the PNPC repeat the undergraduate curricula, just changing the name of them, which is a shame given that students do not interact with a context of academic exigency.

On the other hand, the students that are trained in the public mastery have a more demanding panorama in the formation of the postgraduate. They know that they must manage diverse academic activities to strengthen their training process. They value the profile of their teachers, for example, who are in the National System of Researchers, who have the Desirable Profile of the Professional Development Program of the Secretariat of Public Education, to participate in congresses, to publish, among other activities, that reflect A high professional profile. All this shows that the meaning and meaning of training have been built from the knowledge of current educational policy, its language reflects such knowledge as well as its idea of training that goes beyond simply obtaining a degree.

Supporting the study from the Theory of Social Representations as well as from Symbolic Interaccionism allowed us to understand that the sense and meaning of the term formation is determined not only by the social context from which it is performed daily but also by the interaction that is established with the subjects individually, with groups, with institutions, with themselves. The sense and meaning of formation is built from the ideas, beliefs and expectations that the students themselves have created from their own contexts of formation

and from their own frameworks of interpretation, this relates to those ideas, beliefs and expectations of those others with they had established communication, in an interesting and continuous process of interpretation of sense and meanings, of realities and actions.

6. Conclusions

This work was undoubtedly a first approach to the postgraduate courses that exist in our city, which allowed us to realize that the sense and meaning of the training, are a pillar for professional development, however, in our city the growth of the private sector is having greater weight in the balance since they have designed masters programs that do not care for the operation of the same, their curricula do not have a formative orientation, and they do not have an academic plant with a profile of wide level and, in general, they are not programs of educational and social relevance. It is to be alarmed that few universities are committed to a program of quality, certification and recognition, a greater response is needed from both public and private universities to be able to design graduate programs that meet high standards of national quality and International, offering a range of possibilities to graduates of the bachelor's degree for their training.

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Relative importance of college success predictors: fluid intelligence, crystallized intelligence, and grit

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Abstract

This study aimed to compare the predictive power of grit and two cognitive ability tests of fluid and crystallized intelligence used for university admission on the success of college students in Turkey. Utilizing Cattell's Investment Theory and Ackerman's PPIK Theory of Adult Intelligence, we hypothesized that knowledge tests would be a better predictor of academic achievement in college than tests of fluid intelligence. We collected data from 441 students enrolled in engineering, physical sciences, social sciences, and administrative sciences majors in a technical university. Our results based on hierarchical regression and dominance analyses provided support for our hypothesis. For science, technology, engineering and math (STEM) students, the test of crystallized intelligence not only was a better predictor of college GPA compared to the test of fluid intelligence but also explained incremental variance over and above the fluid intelligence test. For social-administrative sciences, the predictive powers of tests were equivalent to each other. We also found that the perseverance of effort dimension of grit was the best predictor of GPA. Our findings support the notions of the adult intelligence theories suggesting that domain knowledge is a better predictor of typical performance in adults.

Keywords: *fluid intelligence; crystallized intelligence; knowledge test; academic success; grit; investment theory.*

1. Introduction

Cognitive ability has been shown as a successful predictor of school and academic performance (e.g., Kuncel & Hezlett, 2007; Sackett et al., 2008). Nevertheless the predictive power of cognitive abilities tends to decline over the years from elementary school to college and graduate education (Kaufman, Johnson, & Liu, 2008; Lin & Humphreys, 1977; Postlethwaite, 2011). Cattell's (1987) Investment Theory forms the basis for emphasizing that adults invest their general reasoning abilities, that is fluid intelligence-Gf, into areas they are interested in and thus acquire knowledge that makes up another type of cognitive functioning known as crystallized intelligence (Gc) and that Gc and Gf are differentially related to academic success.

Ackerman's (1996) theory of intelligence-as-Process, Personality, Interests, and intelligence-as-Knowledge (PPIK) frames intelligence-as-knowledge as a more specialized form of accumulated knowledge (i.e., occupational or discipline-related) as compared to Gc, which develops from intelligence-as-process and also motivational resources such as vocational interests and domain-related personality proclivities. Ackerman suggested that assessments of intelligence-as-knowledge should incorporate separate measures for each occupational/discipline-related domains. Empirical research provide support for these theories, suggesting that in high school and adult samples, knowledge-based assessments have better predictive power as compared to process-oriented intelligence assessments. Such results are in line with the findings indicating that previous performance and achievement levels are indicators of future achievements (Oullette & Wood, 1998). In educational selection, researchers (e.g., Ackerman & Beier, 2006; Rolfhus & Ackerman, 1999) suggest that higher weight should be given to knowledge measures rather than ability measures. Knowledge measures (e.g., grade point averages) are indicators of typical performance whereas ability measures represent maximal performance. Furthermore, Gc is a better predictor of domain knowledge than Gf. For example, in a recent meta-analysis (Postlethwaite, 2011), undergraduate GPA was better predicted by Gc ($r = .36, \rho = .65$), compared to Gf ($r = .22, \rho = .44$).

Studies that focused on the predictive power of prior knowledge on undergraduate achievement showed consistent results. A meta-analysis (Richardson et al., 2012) reported a moderate effect size of high school GPA on undergraduate GPA ($\rho = .41$). High school GPA explained 21.4% of variance in first year college achievement of American students whereas SAT scores explained only 2.4% of the variance (Fu, 2012). Similarly, in a study conducted in Sweden, high school GPA was a better predictor of graduate GPA than the scores on SweSAT, an exam used for college admissions with content similar to that of the SAT in the United States (Cliffordson, 2008). In a German sample, Gf accounted for 5% of the variance in undergraduate GPA, whereas high school GPA and scores on knowledge tests added 22% incremental variance (Kunina et al., 2007). Recently, Ackerman and

colleagues (2013) found that the correlation of first-year undergraduate GPA with Advanced Placement exam scores, which assessed crystallized domain knowledge, was somewhat larger ($r = .38$) as compared to its correlation with SAT scores ($r = .30$). SAT-I, which is more heavily loaded with questions assessing fluid intelligence, was reported to add close to zero variance in predicting freshman GPA over and above the variance explained by high-school GPA and SAT-II (subject tests). Whereas the subject tests accounted for 22.3% of the variance (Geiser & Studley, 2002).

Similar results pertaining to the relative differentiation of knowledge-based versus ability-based measures of cognitive functioning have been reported in predicting graduate school success (e.g., Kilmen, 2007; Kuncel et al., 2001) and job success (e.g., Koczwara et al., 2012). In line with the literature, in the present study we sought to investigate the predictive power of two tests used in the university entrance system in Turkey: YGS-a measure of intelligence-as-process- and LYS-a measure of intelligence-as-knowledge. We hypothesized that LYS would be a better predictor of undergraduate CGPA than YGS. We tested our hypothesis separately using two clusters of students based on their field of major (STEM and Social Sciences) because the content of LYS test for university admission is different for these clusters. More information on the tests is provided in the methods section. In the analyses, we also included grit as predictor of GPA because of previously reported associations with academic success (Duckworth et al., 2007; Duckworth & Quinn, 2009).

2. Method

2.1. Participants and Procedure

The sample included students at a technical university in Ankara. Upon obtaining IRB approval and participant consent, those who completed our online survey were offered course credit. Students who took the university placement exams (YGS and LYS) after 2010 were eligible for participation. The final sample after data cleaning included 441 students, with 231 enrolled in STEM majors and 210 enrolled in the social/administrative sciences. Sample characteristics for both clusters are reported in Table 1.

2.2. Measures

Participants manually entered their LYS and YGS exam scores. A link that directed the students to the score inquiry webpage was provided so that the students could provide objective and accurate scores. The YGS test is equivalent to a reasoning test such that questions only require very basic knowledge (such as arithmetic) and responding rests on reasoning abilities for novel problems. We utilized two types of YGS scores, one with higher weight on quantitative reasoning (YGS1) and one with higher weight on verbal

reasoning (YGS3). YGS1 comprises 40% numeric, 30% science, and 30% Turkish verbal comprehension questions, whereas YGS3 comprises 20% numeric, 10% science, and 70% Turkish verbal comprehension questions (ÖSYM, 2014). The LYS test is a content-based test such that responding to questions requires relatively more advanced knowledge in different content domains such as mathematics, physics, history and so on. Depending on the major area the student is going for, different university admission tests are taken yielding different composite scores such as a Social-Math score or a Math-Science score. In the analyses, the MS score, which includes mathematics, geometry, physics, chemistry, and biology content domains, was used as the LYS score for the STEM cluster (LYS-MS). The SocM score, which includes mathematics, geometry, Turkish language and literature, and geography content domains, was utilized as the LYS score for the social and administrative sciences cluster (LYS-SocM). Participants also reported their cumulative GPA (CGPA) scores. For those participants who did not report their CGPAs, the latest CGPA was obtained from the university student information system with the students' consent.

Table 1. Demographic characteristics of the sample

(N = 441)	STEM	Social Sciences/ Humanities
Gender N (%)		
Women	85 (36.8)	141 (67.1.0)
Men	146 (63.2)	68 (32.4)
Departmental domain N (%)		
Engineering	176 (76.2)	
Physical sciences	55 (23.8)	
Administrative sciences (Business/Economics)		65 (31.0)
Social sciences/Humanities		145 (69.0)

The 9-item GRIT scale by Duckworth and Quinn (2009) was utilized for measuring students' determination and passion for long-term goals, which was translated and back-translated by two bilinguals for the present study. The scale has two dimensions, namely *perseverance of effort* and *consistency of interest*. Sample items are "I finish whatever I begin" (perseverance of effort) and "I often set a goal but later choose to pursue a different one" (consistency of interest, reverse-coded).

3. Results

3.1. STEM cluster

Descriptive statistics and variable inter-correlations for the STEM cluster are presented in Table 2. In this cluster, CGPA had small correlations with the reasoning test of YGS1 ($r = .17, p < .001$), and the content test of MS ($r = .22, p < .001$). Grit-perseverance of effort had a moderate significant correlation with CGPA ($r = .30, p < .001$).

Table 2. Descriptive statistics and inter-correlations of the study variables for the STEM cluster

	Mean	SD	Reasoning Test – Quant (YGS1)	Content test (LYS-MS)	Grit Effort	Grit Interest
CGPA	2.79	.59	.17**	.22**	.30**	.17**
Reasoning Test – Quant (YGS1)	434.59	37.32		.78**	-.02	.01
Content test (MS)	435.62	44.61			.08	-.04
Grit Effort	4.03	.91			.78	.40**
Grit Interest	3.29	.80				.61

N = 231. Bold fonts are Cronbach’s alpha coefficients. Quant: 70% of test coverage is quantitative.

* $p < .05$, ** $p < .01$.

The content LYS-MS scores alone added 2% of incremental variance over the reasoning YGS1 test in predicting CGPA ($F_{\text{change}}(1, 228) = 4.39, p = .04$). When MS scores were included in the first step, it explained 5% variance and YGS scores did not explain a significant amount of incremental variance over MS scores ($F_{\text{change}}(1, 228) = .001, p = .97$). When the grit dimensions were added in the final step, they together explained an additional 9% variance over the reasoning and content test scores. When all variables were included in the regression, they explained 13.6% variance in CGPA and grit-perseverance of effort was the only significant predictor ($\beta = .26, p < .001$). Relative importance of test types and grit (perseverance of effort) on academic achievement was studied with the dominance analysis approach (Azen & Budescu, 2003; Budescu, 1993). Dominance analysis was preferred over a one-shot regression analysis in order to take account of variable inter-correlations, as the MS and YGS1 test scores are highly correlated ($r = .78$). The reasoning test of YGS shared 2% of variance with CGPA, the content test of MS shared 3% of variance with CGPA, and finally perseverance of effort shared 9% of variance with CGPA. Variables’ contributions to the shared variance were 12% for the reasoning test, 22% for the content test, and 67% for grit. The hypothesis, which stated that the

content test indicative of a knowledge-based assessment would have a larger relative contribution to the prediction of CGPA as compared to a reasoning test, was supported.

3.2. Social-administrative sciences cluster

Descriptive statistics and variable inter-correlations for the social-administrative sciences cluster are presented in Table 3. In this cluster, CGPA had a nonsignificant correlation with the reasoning test of YGS1 ($r = .08, p = .27$) and small significant correlations with YGS3 ($r = .14, p = .04$) and the content test of LYS-SocM ($r = .15, p = .03$). Grit-perseverance of effort had a greater significant correlation with CGPA ($r = .25, p < .001$).

Table 3. Descriptive statistics and intercorrelations of the study variables for the social/administrative sciences cluster

	Mean	SD	YGS1	YGS3	LYS-SocM	Grit Effort	Grit Interest
CGPA	2.78	.68	.08	.14*	.15*	.25**	.16*
Reasoning Test - Quant (YGS1)	350.68	49.68		.67**	.50**	-.06	.00
Reasoning Test - Verbal (YGS3)	395.04	30.26			.55**	.05	.12
Content test (LYS-SocM)	391.52	41.61				.05	.00
Grit Effort	3.86	.83				.72	.44**
Grit Interest	3.16	.80					.65

N = 210. Bold fonts are Cronbach's alpha coefficients. Quant: 70% of test coverage is quantitative; Verbal: 70% of test coverage is verbal. * $p < .05$, ** $p < .01$.

In the social-administrative sciences cluster CGPA was more strongly correlated with YGS3, which rests on reasoning with verbal content, than YGS1 which measures reasoning with quantitative content. However, since YGS3 test has a higher load of knowledge content based on the test manual, it is not suitable for testing our hypothesis, which compares Gf and Gc measures. Therefore, for dominance analysis we utilized YGS1 scores as the reasoning test score. For space purposes, the dominance analysis results for YGS3 are not presented here and are available upon request. YGS1 shared less than 1% variance with CGPA, the content test SocM shared 2% variance with CGPA, and grit (perseverance of effort) shared 6% of variance with CGPA. Variables' contributions to the explained variance in CGPA were 5% for the reasoning test, 20% for the content test, and 75% for

grit. The relative contribution of the knowledge-based test score was four 4 times than that of the reasoning test score. Again, perseverance of effort was the best predictor of academic success.

4. Discussion

Using data collected from both STEM and social sciences students, we found support for our hypotheses that college success is better predicted by Gc than Gf measures. Specifically, for both samples, the knowledge-based test explained greater variance in CGPA than the reasoning test. Our findings offer further contribution to the literature, which reported that intelligence-as-knowledge measures are better predictors of academic success than intelligence-as-process measures (e.g., McManus et al., 2011; Postlethwaite, 2011). We also provide further support to Ackerman's PPIK theory and Cattell's Investment theory. It is also important to note that perseverance of effort dimension of the grit scale performed as the best predictor among all variables in both samples. This finding is in line with the previous studies which found that grit explained incremental variance over IQ scores (e.g., Duckworth et al., 2007) and that non-cognitive variables are important in investing ability-related resources in effortful pursuits (Ackerman, 1996).

Our study is not without its limitations. Our findings are not conclusive for the Turkish exam system because of the limited sample sizes and participant profile. It should be noted that the data collection is ongoing and the results reported here are preliminary. When the sample size is enlarged with sufficient representation of various majors, multilevel methods can be utilized to test the relative contributions of crystallized and fluid intelligence on academic success for students from different domains.

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Learning Pronunciation with OERs: a practical case for Medicine students

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Abstract

The aim of this study is to improve English pronunciation in the university classroom of first-year Medicine students through the use of OERs. Technologies such as Voki or LEO network are used in the practical sessions of the English for Health Sciences module. Voki platform allows learners to practise and improve their fluency and spoken skills in the target language. LEO network was also used to allow students to exercise and check their pronunciation performance with the tool 'Learn English through dictation'. Two surveys addressed to students tried to delve into their level of English pronunciation and the importance given to this ability up to now. We aimed at knowing how much the students were exposed to pronunciation training before entering university and whether this training was presented through the use of new technologies. First-year Medicine students seemed motivated to the improvement and learning of pronunciation techniques through the use of OERs. A final questionnaire revealed that, although the teaching proposal with the use of computer tools was rewarding, not all of them seemed so fond of new technologies as expected.

Keywords: EFL; Medicine students; teaching pronunciation; OERs.

1. Introduction

In recent years, several studies have acknowledged the immense potential of OERs for teaching and learning due to the generation of new abilities in the classroom related to forms of communication or collaboration (Conole & Alevizou, 2010). Regarding the teaching and learning of languages, it has been claimed that OERs are able to reduce the time needed to prepare classes (Wenk, 2010) as well as to reduce teachers' isolation by using dialogic and more learner-centred approaches (Mayes & Freitas, 2004).

Higher Education Institutions have been urged to widening the use and creation of OERs. In the last decade OERs have gained place in universities due to the European policies published after the Bologna Declaration. OERs have been attributed many beneficial learning and teaching skills for the university classroom, since their free and easy access have undoubtedly the potential of becoming universal and available to the whole learning and teaching community. However, some authors have noted the risks of OERs as regards social exclusion. Those not fond of new technologies or not connected could be left behind and excluded from the classroom community.

The current paper presents the results obtained after introducing the use of some specific OERs for the learning of English Pronunciation to a group of first-year Medicine students enrolled in their English for Health Sciences module. The participants had never used the OERs introduced in the classroom before. Although a very positive response was hypothesized, the answers from a survey measuring students' satisfaction with the sessions revealed that not all the students were prone to use OERs in their Pronunciation module. Several activities were designed to be fulfilled with the use of some OERs which, although no specifically designed for language teaching and learning, have proven to be useful for that goal.

2. The Medicine classroom

The classroom setting under which the study takes place is that of a first year degree in Medicine, a total number of 63 students were exposed to OERs to improve English pronunciation in the English for Health Sciences module. For these students English is taught as a foreign language and the four skills are practised in class, i.e. reading, writing, listening and speaking. They are exposed to medical texts; both written and spoken, terminology is specific to the field. A high percentage of the total subject grade is devoted to the spoken understanding and production (5.5 out of 10), so pronunciation becomes an important asset in the oral tests, these include: group presentation on a medical topic or a dialogue in a consultation between doctor and patient or patient and nurse.

2.1. The surveys

Two different surveys were created and passed on the Medicine students to be filled in before and after the session. The first initial questionnaire included questions regarding personal data such as gender and year of birth. It is important to mention at this point that both surveys were completely anonymous. Some other aspects of the questionnaire gathered information about their proficient use of OERs and other technologies or their level of English.

The final survey aimed at gathering information about their satisfaction with the session and the usefulness of the OERs presented and used. In this final survey they had to number in a 5-point likert items such as: a) *Using OERs to fulfil the activities has increased my motivation to communicate in English*, or b) *The activities done using OERs are not attractive and dynamic* (see Appendix for details).

3. The activities

The activities designed included exercises to be fulfilled with the OERs that had been previously explained. The first activity, aimed at practising vowel and consonant sounds in isolation, required the use of the dictation tool and the text-to-speech option. Afterwards, students had to check the pronunciation of the words listed and then record themselves using *Voki*.

The second activity was designed to practise the pronunciation of words that may be tricky for students. To complete it, learners were provided with the tongue twister that goes as follows: *If two witches watched two watches, which witch would watch which watch?* Then, they were again asked to record themselves on *Voki*. For reasons of space the activities cannot be included in the paper.

Next section presents some of the pronunciation improvements and mistakes made by the participants in the study while using the OERs proposed.

4. Results and discussion

As regards the activities designed to implement the use of OERs in the Medicine classroom, the results of the activities concerning vowels and consonants as well as minimal pairs are now provided.

4.1. Vowels and Consonants

Results from the vowels and consonants activity are quite striking. Figure 1 below illustrates the number of words with silent consonants that were mispronounced by Medicine students. In fact, despite having the opportunity to practise and hear the words as many times as they considered necessary before recording them, it can be clearly seen that nearly 25% of the participants had serious difficulties in identifying words with silent letters.

The figure below shows that the most salient mispronunciations correspond to *bomb*, *receipt* and *doubt*. Around 20 students pronounced *bomb* as /bɒmb/, *receipt* as /re'si:pt /, and *doubt* as /daobt/ or /dabt/. These pronunciation errors are closely followed by *hymn* and *numb*. The phoneme /h/ in *hymn* is replaced either by a sound similar to the Scottish 'ch' (Coe, 1987) or by pronouncing the /n/, thereby resulting in /hɪmn/. On the other hand, *numb* tends to be recorded as /nʌmb/. This is a common error among Spanish speakers since there is an influence of spelling on pronunciation. As a result, unknown words tend to be pronounced as spelt (O'Connor, 2009).

Accordingly, some of the participants did not distinguish the phoneme /ɑ:/ in *castle*, given that vowels have no length in Spanish (Coe, 1987). Oddly, two students pronounced /'kɑz.səl/ instead of /'kɑ:.səl/. The number of mispronunciations decreased considerably in words like *island*, *autumn* and *knee*, which seemed to be recognised easily.

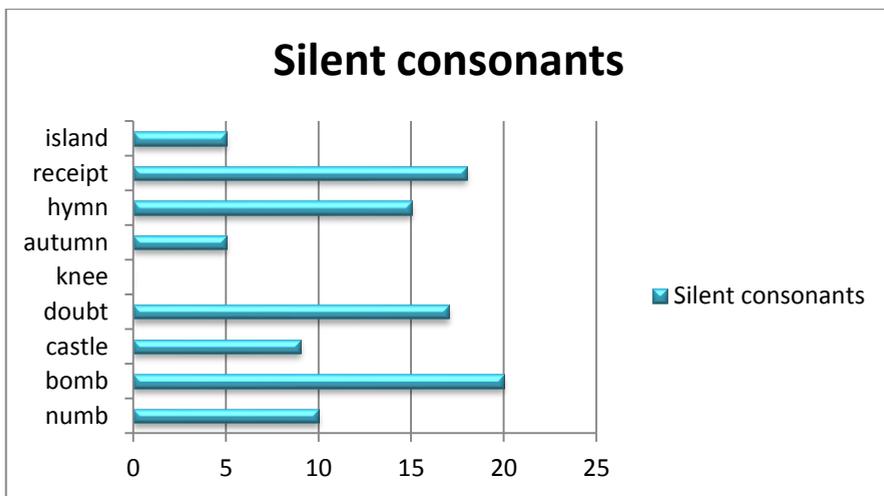


Figure 1. Silent consonants

Figure 2 that follows shows similar trends. As for the word *starving*, approximately 34% of Medicine students pronounced the phoneme /v/ as /b/, considering that both of them sound exactly the same in their mother tongues, either Spanish or Catalan. Likewise, the phoneme /ŋ/ does not appear at the end of a word in Spanish, so that *starving* is pronounced as /'sta:vɪŋ/. Occasionally, *enough* and *believe* were pronounced as /e'nʌf/, /ɪ'noug/, and /be'li:v/ respectively. Another mispronunciation that deserves special attention is that of *rude*, in which the /r/ is flapped (Coe, 1987).

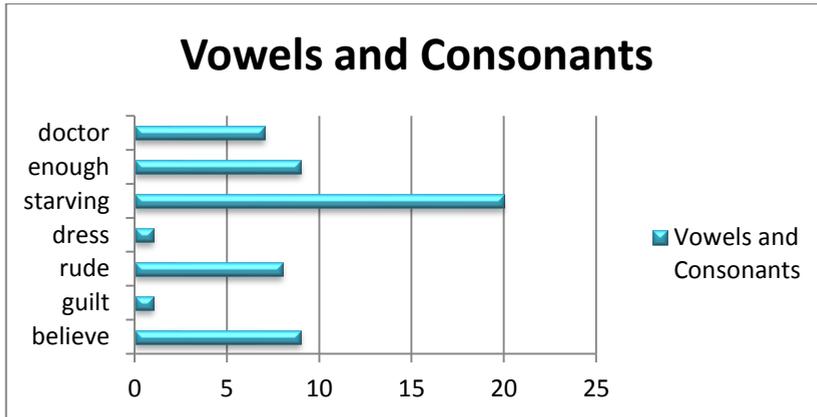


Figure 2. Vowels and Consonants

4.2. Tongue Twister

Results from the tongue twister activity suggest that most students could complete the activity satisfactorily. Nonetheless, at times participants had some problems in words like *two*, *watched*, and *would*. In this sense, 8 out of 63 learners forgot about the aspiration in /t/. Moreover, thirteen students failed to pronounce the -ed in *watched*, which was not articulated as in *cooked* /kʊkt/ but as in *wanted* /'wɒn.tɪd/. As can be observed in Figure 3, the word *would* seemed to be the most challenging one. Actually, the silent /l/ was pronounced by fourteen participants.

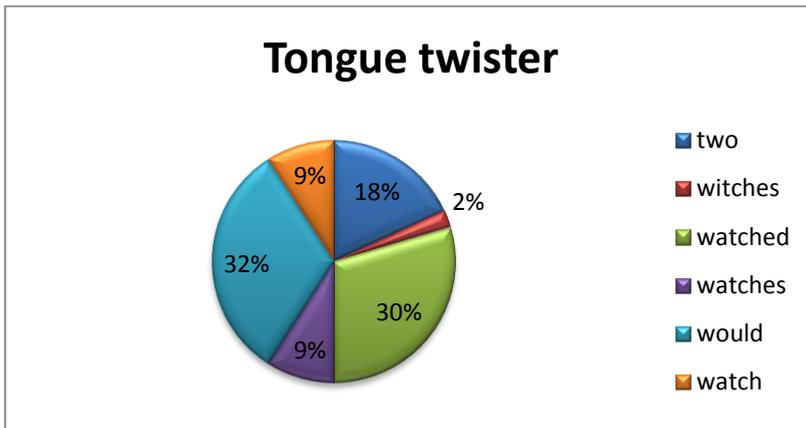


Figure 3. Tongue Twister

5. Conclusion

Technological tools such as *Voki* or *LEO network*, and more concretely the resource ‘Learn English through dictation’ have been explained and presented to university students in their English for Health Sciences module in order to improve and practise their English pronunciation.

As to the surveys explained above, it is worth to point out here that question 1 corresponding to the Final Survey, that is, *I consider a waste of time learning with OERs. It slows down the learning process and should be optional* (see Appendix), was given a 4 in a scale from 1 to 5 in 23 occasions from a total of 63 students. This figure is quite elevated or at least higher than we expected. The inclusion and use of OERs in a session within the English for Health Sciences module was expected to be largely accepted by the students. This result might be due to the raising issues in terms of social exclusion already mentioned. We realized that the students used different devices other than the regular PC. Some used tablets, others laptops, and not all them used the same operative system or browser, which caused some problems when using some of the resources proposed, as for example *Voki*, since it is in sync with Google and not with other web browsers such as Opera.

OERs are meant to engage students in the learning process of the target language and so occurred with the activities proposed for the session. OERs allowed students to work autonomously and at their own path. From the results obtained, we observed that the flexibility of OERs permitted students to record themselves a many times as needed and listen to the target sound easily, which enhanced their pronunciation improvement. Only 20

out of 63 EFL learners showed some pronunciation problems in their final recorded production of words such as *receipt* and *starving*.

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Appendix: Final Survey

Students' Questionnaire

Questions	less-more				
	1	2	3	4	5
1. I consider a waste of time learning with OERs. It slows down the learning process and should be optional.					
2. The activities done using OERs are not attractive and dynamic.					
3. Using OERs to fulfil the activities has increased my motivation to communicate in English.					
4. I am able to manage my own language learning by using OERs.					
5. The implementation of OERs is aimed at developing the competencies established in the course syllable.					
6. The use of OERs has allowed me to improve my English pronunciation.					
7. I will keep using OERs at home.					
8. I am satisfied with this teaching proposal.					

Observations / Suggestions for improvement

The reciprocal value of Doctoral Design Research when housed within a Creative Business Center: a case study in Porto, Portugal.

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Abstract

This paper presents the case study of a pilot partnership between a Doctoral Program in Design and a Science and Technology Park located in Porto, Portugal. The partnership has been in effect since 2013; the Doctoral Program has resided within the premises of the Science and Technology Park, as an immersive research environment, in order to foster knowledge transfer and collaborations through gradual, mutual and informal recognition of reciprocal assets.

We contextualise the premises and stakeholders in this partnership, outline the empirical methodologies employed, and provide examples of selected projects that illustrate the implementation of these methodologies.

Furthermore, we provide an inventory of challenges detected throughout the development of the partnership, as well as information on how these challenges are being overcome.

We conclude by summarising the main accomplishments of this partnership, as well as outlining validation by various external agents and opening up prospects for future development. These will include thorough materials that may be of use for implementation in other academic, scientific and entrepreneurial environments.

Keywords: *Design research; Doctoral research; entrepreneurship; knowledge transfer; creative industries.*

1. Introduction

This paper presents the case study of the Doctoral Program in Design [PhDDesign] of the University of Porto [UP] as mainstay of an experiment in knowledge transfer. Based at UP's Science and Technology Park [UPTEC] since 2013, PhDDesign has co-developed the hypothesis that for Design Research to flourish and consolidate itself as an Applied Science Field, it may benefit from a primary strategic location within a creative industries center.

A research question may therefore be summarised as follows:

Can the bridges between design research and industry be most effectively consolidated by primarily hosting PhD research in an entrepreneurial environment, rather than an academic one?

The objectives of the experiment can be summarised as follows:

- To contribute to the consolidation of a culture of applied design research;
- To contribute to a rooting of reciprocal collaborations and added value between design research and contemporary entrepreneurial environments;
- To contribute to the legitimisation and credibility of design research as a multidisciplinary interface.

2. Context

PhDDesign was created and formally accredited in 2011 at the University of Porto. The course is biennial with three editions as of January 2017. Its premise is the consolidation of a recent culture of design research, in particular with regards to the potential for regional scale development (in partnership with the University of Aveiro and ID+, Research Institute in Design, Media and Culture), as well as its binding potential with the entrepreneurship sphere - in particular in the emerging ecosystem of micro, small and medium-sized enterprises [SMEs] in creative fields.

UPTEC is a structure for supporting knowledge transfer between University and market. It fosters the creation of technological, scientific and creativity based companies, enabling multiple relationships between Portuguese and international innovation centres. UPTEC has been providing a vital contribution to the social and economic leverage of knowledge produced at the University of Porto, and has already supported over 450 business ideas, hosting about 200 projects every year. In 2013, UPTEC won the RegioStars Award, which identifies good practices in regional development and highlights original and innovative projects that may be inspiring to other regions. Through its engagement with creative businesses, the key role of design as business opportunity and a fundamental tool for

market differentiation to any company (regardless of its economic sector or stage of development) has gradually become evident in the context of UPTEC.

The above frameworks led to the submission of PhDDesign to the Foundation for Science and Technology [FCT] call "Doctoral Programmes" in February 2013. UPTEC was presented as the interface partner for the development of an exploratory culture of collaboration; a strategic emphasis was placed on its Creative Center [UPTEC PINC].

The application earned an excellent evaluation, with a 9/10 rating on all four evaluation parameters. Comments by the international evaluation jury included the following statement:

“The results of the program could have an important positive social and industrial impact on the Portuguese and international scene”. FCT (2013).

Following this application, the Vice-Rector for Research and Development of U.Porto supported the physical placement of the PhDDesign at UPTEC PINC, as a way of fostering the promise contained in the application. This residency was implemented in September 2013, with the full support of the Executive Directorate of UPTEC and the UPTEC PINC infrastructure. Since then, 17 students have been conducting their research in an immersive environment, while enhancing its intersection with the functional and prospective universe of UPTEC. The fact that 14 of these students’ research has been fully funded by FCT ensures the desired level of commitment.

3. Methodologies

The approach to the challenge has been threefold:

- Ensuring the admission and development of doctoral projects best suited to knowledge transfer and using design research as a multidisciplinary interface; a research proposal is required upon application, and candidates are invited to clarify their proposals’ potential for implementation and development. Subsequent project development of accepted students follows up on this ambition.
- Ensuring curricular content and activity that consolidates the stated reciprocal mission; this has included the mapping of spatial dynamics at UPTEC centers, design and consultancy services with companies and the UPTEC School of Startups, a series of printed materials focusing on good practice in communication environments, and the joint envisioning of innovative strategies of institutional communication.
- Fostering extra-curricular contexts of conviviality and opportunities for collaboration; these have included the creation of a small permaculture farm (subsequently maintained by

startup company Noocity), holding a series of free-access, hands-on workshops (FuturePlaces medialabs), and the co-authorship of projects (ethno-branding project Porto Pelo Porto with contributions from FAHR021.3, The FuturePlaces Fountain Project in coordination with Still Urban Design, and Radio Manobras, an independent, community-led radio station that is both a PhD case study and the prospective host of a set of radio interviews on the subject of design research).

The above fronts are articulated and monitored on a primarily empirical basis, with regular scientific board meetings where a calibration is performed as required by specific instances. It is also worthy of note that the above approaches are reciprocally contributive between themselves; as an example, the farm began as an informal context, and has meanwhile been scientifically validated as a case study by one of the doctoral researchers.

4. Case Studies (sample)

We summarise three sample cases that illustrate the above methodological geometry into a tangible framework, while revealing examples of mechanics and challenges that emerge empirically.

- The re-capacitation of regional traditional industry through implementation of startup principles and customised design processes (an example of fostering the recognition of collaborative opportunities)

This pilot project currently involves UPTEC and PhDDesign as strategic partners for the recovery of a traditional shoe factory in the greater Oporto area - that, like many others, faces imminent bankruptcy. This study is meant to be a testbed for the possibility of implementing selected startup principles as a mechanism of modernisation and flourishing of an ailing traditional industry sector. Complementary input is provided by PhDDesign students Abhishek Chatterjee and António João Gomes within the scope of their theses, and post-doctoral researcher Pedro Carvalho de Almeida, whose research focuses on inventories and narratives towards the recognition of local brands as cultural heritage and economic assets.

- Ascertainment of the potential impact of design on [medical pathology designation withdrawn for issues of confidentiality] (an example of doctoral projects best suited to knowledge transfer and design research as a multidisciplinary endeavour)

A doctoral research project, admitted to the doctoral program in 2015, concerns design for a specific medical condition. Within the Course strategy, the project signals a multidisciplinary approach, as it is receiving co-supervision in medical fronts, and consolidates an emerging interest and potential for patenting.

- UPTECX+ (an example of curricular activity that consolidates the reciprocal mission)

As part of the celebration of ten years of UPTEC (slated for September 2017), PhDDesign students were invited to envision unexpected ways of communicating UPTEC - with the possibility of future extrapolation towards broader institutional communication. The briefing emphasises the character of the expected outcomes: open-ended, experimental, bold - while remaining conceptually sound. Three research challenges were posed to the students:

1. What, in my UPTEC experience, needs input / improvement / change on a design level?
2. What competences do I have that may be of use to communicate an institutional environment in 2017?
3. How can my research be connected to this challenge? Can this become a case study of my own?

Following a series of field work sessions with companies (including informal interviews and data collection), students are currently developing a glossary of new terms for entrepreneurship, an ongoing installation with contributions from incubated companies (present and future), and a promotional video that strengthens semantic ties with local culture. Furthermore, the outputs will inform the development of UPTEC's institutional rebranding.

5. Main Challenges

The empirical work developed since late 2013 has revealed a set of challenges: while expected as a whole, their specificity can only be managed as live processes of interpretation and incorporation.

A gap is yet to be overcome between students' general availability and willingness to engage in exploratory fronts, and the companies' frequent unavailability due to professional commitments, deadlines and the imperative of profit. A clear path is the identification and unequivocal communication of reciprocal value, i.e., how can researchers and companies benefit by collaborating in exploratory environments? Sensitive intermediation is necessary from both ends (namely by the PhDDesign and UPTEC coordinators), and simple clear rules have to be in place to make sure that researchers and companies fully understand the goals and limits of such collaboration in order to avoid potential conflicts and liberties: neither are the researchers to be regarded as permanently available design consultants, nor should the companies' availability and data be regarded as readily accessible (various of these projects have very few resources, human and otherwise, as well as confidential information that cannot be shared); copyright issues should also be closely monitored.

These challenges are being addressed on an individual basis, as each project and prospective collaborations raise distinct issues.

The time span of the originally proposed objectives has revealed a certain degree of over-ambition: the implementation of a fully flourished design research culture, as well as its concurrent recognition of affinities and complementarities with industry, has required a temporal adjustment due to the intrinsic complexity of the various stakeholders and the relative absence of prior templates. A pedagogy of applied design research in entrepreneurial environments needs to be regarded as a longer-term challenge. The same applies to the development of an entrepreneurial culture that regards the coexistence with design research as a competitive advantage for its businesses.

A more balanced approach will be required when it comes to geographical and semantic relocation of the course; despite the clear advantages and strategic advancements, the maintenance of PhDDesign in academic environments should not be bypassed entirely. This is being addressed through the organisation of exhibitions, the hybridisation of the PhDDesign student body with students from other PhD programs (and Masters courses), and the organisation a series of annual conferences on design research (“UD”).

6. Conclusions and future prospects

This pilot partnership in knowledge transfer has already proven to be informative in external contexts: namely, Universities and courses that have come in contact with it, through project co-supervision, external examination, guest lecturing, mobility programs, and forum attendance. Various aspects of this partnership are fostering cooperation of various scales and natures with other academic environments, through validation, replication, and joint strategic enquiry. There various typologies of cooperation will be the subject of further communication.

At the time of writing, we are able to signal cooperation with the following academic fronts:

- the University of Aveiro, Portugal (partner institution in various curricular units, joint conference organisations, and scientific consultancy);
- the University of Coimbra, Portugal (namely in the reciprocal collaboration with the Doctoral Program in Human Rights in Contemporary Societies, expressed in co-supervisions and keynote addresses);
- the University of Lisbon (forum keynotes and think-tanks for implementation of aspects of PhDDesign as course templates elsewhere);
- the University of Brighton (reciprocal consultancy with Faculty of the College of Arts and Humanities);

- Central Saint Martins / University of the Arts London (prospective co-supervisions and consultancy towards the consolidation of knowledge transfer at PhD research level);
- the University of Saint Joseph, Macau (by integrating its Dean of Creative Industries on the Course Advisory Board, as well as welcoming staff and students into research workshops co-organised with the Macau Institute of European Studies);
- the inclusion of Professor Jon Wozencroft (Royal College of Art, London) in the Course Advisory Board;
- Doctoral co-supervision by a Professor of Product Design from Istanbul Technical University;
- Aalto University: prospective cooperation with the PhD Program hosted by Aalto University School of Arts, Design and Architecture / EMPIRICA Research Group;
- UTAustin|Portugal: student involvement in numerous workshops conducted within the framework of futureplaces medialab (a partnership the University of Texas at Austin).

We overall regard the partnership between PhDDesign and UPTEC as successful in the accomplishment of its original premises; its pioneering nature, as well as the various projects and fronts that have been bearing fruit, have been further validated by both institutions, collaborating partners and associated agents.

However, the project will require further development in order to fully accomplish its goals, namely by following up on course graduates' own paths of knowledge transfer and consolidation of value. Similarly, it seems premature to fully assess the mutual benefit of the interchange between companies and PhD research. A number of relationships between both entities have been forged that point towards longer-term spans and outcomes. Nevertheless, impact may be regarded as immediate on specific fronts: examples are the demand for design consultancy by incubated companies, and the individual networks that students have been developing with startups that may be of relevance to their research.

Given the exploratory nature of this partnership, and in the absence of a prior template, challenges and the need for adjustments are inventoried and acted upon by the Course Scientific Board in coordination with the UPTEC executive directors.

A thorough report is currently under production, in cooperation with the course's Advisory Board, with completion set for late 2017, after the graduation of the first set of students admitted in 2013. Besides a balance of activities and outcomes, we intend to include a set of recommendations for implementation by interested parties within analogous contexts.

This pilot partnership in knowledge transfer has already proven to be informative in external contexts: namely, Universities and courses that have come in contact with it, through project co-supervision, external examination, guest lecturing, mobility programs, and forum attendance.

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A case-based tool to assess college students' perceptions about ethical competence

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Abstract

The main objective of this study was to design a new tool to explore the perception of professionally-related ethical values in Health Sciences undergraduate students. For this purpose, 24 conversational interviews, as well as an extensive literature review, were initially employed. Then, five ethical values were selected: respect for the patient, altruism, empathy, responsibility for my actions, and lifelong learning. Next, twenty cases with ethical dilemmas were created with protagonists pertaining to four degrees in the Health Sciences: Nursing, Dentistry, Physical Therapy, and Medicine. These cases were examined by professionals from these fields and presented to a sample of students to analyze their functioning. Our results indicate that the cases are easy to understand as most cases were identified correctly. Interestingly, students reported "respect for the patient" as the most important ethical value. The least important value was "altruism." This new tool adds a practical perspective based on clinical cases with real-life dilemmas. Further studies are needed to continue exploring this topic.

Keywords: *ethical values; ethical competence; ethical learning; college learning*

1. Introduction

Democracies in the 21st century are pluralistic societies in which citizens accept moral standards based on human rights and countries' constitutions. Today, our universities, undoubtedly, are also in need of educating these responsible citizens for an ethical commitment to serving public service (Martínez, Buxarrais, & Esteban, 2002).

Generally speaking, European countries have recently witnessed a dramatic growth in research production in educational competencies, coinciding with the start of the European Higher Education Area (EHEA), the result of the political will of 48 countries whose aim is the advance of higher education (Trilla, Jover, Martínez & Romaña, 2011; Naval, García, Puig & Santos, 2011; Martínez, 2008; Fabregat & Pérez-Cabrera, 2008; Martínez & Esteban, 2005; Escamez, Ortega & Martínez, 2005; Bolívar, 2005; Lozano, Boni, Siurana & Calabuig, 2003). Importantly, EHEA has established that training and evaluation of future graduates must be based on formation in competencies. In this line, the Spanish National Agency for Quality Assessment and Accreditation (ANECA, in Spanish) also considers the training in competencies as assurance of quality results and one of the instructor priorities, even if this implies a deep change in the current way of teaching (Montemurro et al, 2013).

The field of health care raises numerous ethical concerns. Accordingly, Health Sciences students should comprehend what the values accepted in society are and be trained in those directly linked to their particular profession. This way, they may become better professionals able to act on ethical values held by their patients and their own. To the best of our knowledge, no studies exist regarding ethical values related to a professional context in college students. The aim of this study, therefore, was to design the first tool to assess the perception of ethical values in a professional context by undergraduate students in the Health Sciences.

2. Methodology

Initially, a qualitative study was conducted in which university students maintained conversational interviews with the aim of identifying, in a general way, the ethical values they considered more important to become good professionals (Hernando et al, 2014). An accidental and purposive sample of twenty-four first-, second-, and third-year students of Health Sciences (Medicine, Physical Therapy, and Sports Sciences) was used. Their average age was twenty years of age, with equal sex proportions. These interviews were conducted by three researchers who collected all the comments and ideas of the students for discursive representation analysis. This data was also complemented with a literature review on the most relevant ethical values for the professional world (Mercader, 2006; Montemurro, 2013).

Taken together these two sources of information, we identified five ethical values that were found repeatedly: respect for the patient, altruism, empathy, responsibility for my actions, and lifelong learning.

Next, definitions for each of the selected values were created as follows:

Respect for the patient: respect for the patient is not only courtesy and politeness that certainly must preside over the relationship of the health professional with their patients, but also the absence of discrimination, either external/objective (race, religion, social and economic situation) or internal/subjective (feelings that the patient inspires to the health professional or the illness that the patient is suffering from).

Altruism: capacity to act selflessly in benefit of others who need help.

Empathy: capacity to put yourself in someone else's shoes, to understand what goes through their mind, how and why they might feel that way, not from our personal perspective but taken into consideration their thoughts, beliefs and values.

Responsibility for my actions: to feel responsible for our own actions and decisions, assuming obligations that correspond to these professional roles maintained in a society.

Lifelong learning: personal commitment to a continuing professional development to improve the quality of the care provided to the patient. It implies to be properly updated on the scientific theoretical knowledge, and being able to apply this to their professions.

In order to assess how students respond to real ethical concerns, a questionnaire was designed containing a series of clinical cases with ethical dilemmas. The protagonists of the cases were professionals or students from several areas in the Health Sciences: Nursing, Physical Therapy, Dentistry and Medicine. A total of 20 cases (4 for each area) were used, all based on real cases. An example of a case is the following:

CASE 17: Nuria is a 4th-year undergraduate student in Dentistry. She is busy finishing up some school papers with a deadline for today. Her mentor at a clinic has just called her up requesting her help to perform a root canal this very same day. Nuria has serious doubts about her preparation to perform this technical procedure, but agrees on helping. At the clinic, even if her mentor has not arrived yet she agrees on starting the procedure trusting that her mentor will not be too late.

These cases were reviewed by a group of experts consisting of professionals from various degrees (i.e., Nursing, Physical Therapy, Dentistry and Medicine). Then, a group of 26 undergraduate Psychology students were used to validate this test in a pilot study. For each of these cases, students had to express their level of agreement with an ethical behavior (in a Likert scale ranging from 1, low agreement, to 5, high agreement) and categorize the case into five ethical values (i.e., respect for the patient, altruism, empathy, responsibility for my

actions, and lifelong learning), for which definitions were provided. We were also interested in exploring if volunteering experience could be a factor to take into consideration.

Statistics tests such as Pearson correlation and student t-test were performed when appropriated with the statistical program SPSS (version 20). Data were represented as means (and standard deviations) and percentages.

3. Results

The sample was comprised of 26 undergraduate Psychology students in their third and fourth years. The average age was 26.12, with 23% men and 77% women. A total of 11% of the students reported having participated in volunteering.

Table 1. Mean scores (and standard deviations=SD) for the cases

Ethical values (Cases)	Mean Score (SD)
Respect for the patients	
- Case 1	2.27 (1.19)
- Case 2	1.19 (0.4)
- Case 3	1.62 (0.85)
- Case 4	1.54 (0.65)
Empathy	
- Case 1	1.19 (0.4)
- Case 2	1.81 (0.85)
- Case 3	1.85 (1.12)
- Case 4	1.46 (0.76)
Responsibility for my actions	
- Case 1	1.62 (0.75)
- Case 2	1.19 (0.49)
- Case 3	2.42 (1.06)
- Case 4	1.73 (0.83)
Lifelong learning	
- Case 1	2.08 (1.4)
- Case 2	1.19 (0.4)
- Case 3	1.65 (0.69)
- Case 4	2.54 (1.5)
Altruism	
- Case 1	2.5 (0.91)
- Case 2	2.92 (1.2)
- Case 3	2.69 (0.97)
- Case 4	2.65 (0.94)

Mean scores (and standard deviations) for each ethical value (each corresponding to a dilemma or problematic situation) are presented in Table 1. Test scores ranged from 1.19 and 2.92, indicating that these third- and fourth-year students can identify ethical situations in a professional context. Indeed, “responsibility for my actions” was categorized correctly by most students, 88 %. “Lifelong learning” by 84%, “respect for the patient” by 75%,

“empathy” by 70%, and lastly, “altruism” by 57%. “Altruism,” for many students, was undistinguishable from “responsibility for my actions.”

Interestingly, students categorized ethical values in this order of importance (see Figure 1):

- (1) “Respect for the patient”
- (2) “Empathy”
- (3) “Responsibility for my actions”
- (4) “Lifelong learning”
- (5) “Altruism”

Finally, no statistical differences were found for sex, age, or volunteering effects.

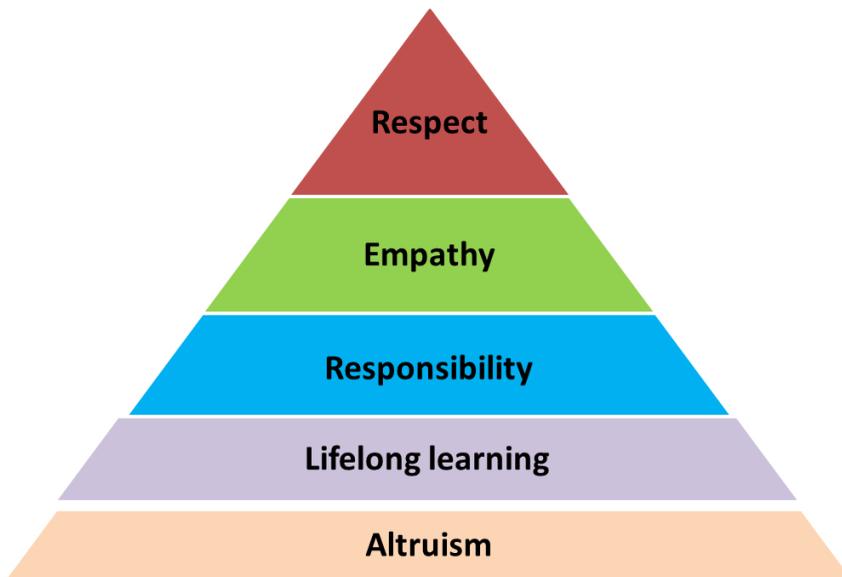


Figure 1. Students categorization of ethical values in order of importance (from top to bottom)

4. Discussion

The aim of this study was to design a new tool to explore the perception of ethical values in undergraduate students in the Health Sciences. Ethical competence in teaching universities tends to be considered under a general theoretical prism. The inclusion of clinical cases in this questionnaire, though, has favored a focus on professional values linked to more practical aspects of the field of ethics.

This pilot study, conducted in a small sample (so the questionnaire will need further validation) permitted verifying clarity of the cases. For most cases, students identified correctly the ethical values related to either professional or student protagonists. These

students reported that “respect for the patient” was the most important value. On the contrary, “altruism” was regarded as the least important. No statistical differences were found for sex, age, or volunteering experience.

Further studies are warranted in a bigger sample of over 500 students from several degrees to clarify differences in perceptions about ethical competence between first- and last-year students. This investigation is intended to answer the question of whether formative training can affect student perception of ethical values along years.

All in all, training of good health care professionals requires adding the ethical competence into the curriculum of Health Sciences degrees as well as extra motivation and implication by instructors. Here we presented a new tool to help understand the ethical competence from a practical perspective based on clinical cases with real-life dilemmas. However, further studies are needed to continue exploring this topic.

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Action research plan to boost participation in college students

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Abstract

Tackling difficulties related to student participation in the college classroom is central on the learning process. In this action-research study, we designed and implemented an action plan to boost participation on the grounds of (1) explaining the objectives and procedures for each activity to students; (2) requesting student participation by name; (3) giving them time to reflect before participating; and (4) requesting that students who are not paying attention participate. A survey was used in order to assess students' perceptions of the action plan. The questionnaire included 10 items (1-4 Likert scale) and was completed by a total of 103 students. The scores' mean was 3.19, demonstrating a positive student perception of the action plan. The statements with the highest average scores were: "Teacher allows time for reflection after posing a question" and "Teacher addresses specific students by name." The instructors recorded their perceptions into writing, providing opinions on the development of the action plan. These teachers' comments were summarized into categories. In conclusion, we considered that the action plan helped to improve student participation, and we believe that in order to obtain sufficient participation we have to attain a classroom environment that favors motivation, confidence and respect for students.

Keywords: Participation, college students, learning climate, action research

1. Introduction

General agreement exists about the importance of participation in university education; for instance, enabling students to become involved in their own learning and enjoy their learning process (O'Connor, 2013). Other benefits of participation include increases in students commitment and better understanding and critical thinking (Heyman and Sailors, 2011). Furthermore, student participation has been shown to encourage active learning, improve work habits and develop specific skills, which are key ingredients for success in the professional world.

Improving participation in the classroom requires instructor awareness of a wide variety of factors that may influence participation. Briefly, we summarize the literature on the topic through the prism of student, instructor and class characteristics.

Student characteristics are central to participation in such a way that older students, students that are more confident, students who care less about their classmates' opinions and students with more teacher contact outside the classroom tend to participate more (Weaver, 2005). Personality variables may also direct interactions in the context of the learning process and have an impact on students' emotional self (Orejudo, Nuño, Fernández, Ramos, & Herreros, 2007; Rinaudo, Donolo, & Chiecher, 2002). In this line, students with a higher degree of shyness and introversion may have difficulty participating and some may be afraid to participate in large groups.

A few studies have focused on analyzing student perception of the idea of participation. A majority of students believe that classroom participation contributes to learning, skills and personal development. Students believe that teachers using participative methods show more concern for the students' education and for communication both as amongst students as well as with teachers (Fritschner, 2000; Alkandari, 2012).

Regarding instructors' traits, the ability to foster communication and support students, as well as to provide different points of view on topics being discussed in class, are considered important (Rinaudo et al, 2002). Gender differences in teacher behavior were identified between male and female teachers; female teachers were more likely to provide follow-up, positive verbal reinforcement and feedback and were able to develop a more comfortable environment for participation (Tatum, 2013). Some authors have addressed the difficulty faced by teachers in evaluating participation. In this regard, students usually see a subjective component in such evaluations (Dirk, 2010; Heyman & Sailors, 2011).

Other factors involve the class. For example, significant differences in participation have also been identified depending on group sizes (Alkandari, 2012). In small groups, students tend to ask more questions, show more interest in the content, think that they are better developing their critical thinking skills and are more satisfied in general with the class

(Hamann, Pollock & Wilson, 2012). Moreover, as regards advanced courses, both students and teachers expect it to be participative and act in accordance with that expectation so that teachers encourage participation more and students get more involved. In basic courses participation is usually elicited or initiated by the teacher, whereas in advanced courses, participation is more often initiated by the students themselves (Fritschner, 2000).

Although the importance and factors of participation have been studied previously, infrequent and inadequate participation continue to be a serious problem in our classes. For this study, we implemented an action research plan that would allow us (1) to motivate our students to participate and (2) to assess their perception of this plan. Ultimately, this learning experience may help other educators achieve authentic participation in their students.

2. Methodology

Figure 1 summarizes the most significant stages of the action research methodology implemented in this project. In this action-research study, we initially developed a definition of participation based on the scientific literature as well as our personal reflections (*Defining the problem situation*). The definition reads as follows: “Any type of student engagement in the classroom that gives rise to different interactions with the teacher as well as other classmates.”

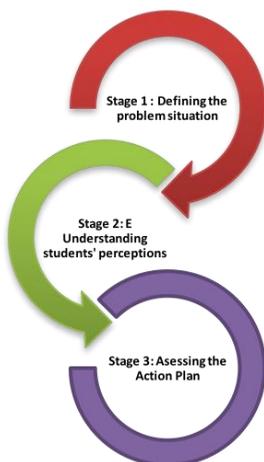


Figure 1. Stages of the action research cycle

Next, we gained a deeper understanding of teacher and student perceptions of participation using a mixed methodology (Tabera, Alvarez, Hernando & Rubio, 2015) (*Understanding the real situation*). Then, we designed and implemented an action plan to boost

participation in college undergraduate students (*Action plan*). Finally, the effectiveness of the action plan was assessed by self-report measurements and reflective writing (*Action plan assessment*).

The sample was comprised of the following groups of students: four groups of second-year medical students in the Basic Epidemiology and Applied Biostatistics and Medical Psychology classes; one group of first-year Criminology students in the Quantitative and Qualitative Research Techniques class; one group of third-year Criminology and Law students in the Quantitative and Qualitative Research Techniques class; one group of first-year Psychology and Criminology students in the Sensation, Perception and Attention class; one group of second-year Psychology students in the Motivation and Emotions class.

Prior to implementing this plan, each teacher held an information session where they provided students with an explanation of the research project to be carried out and, in particular, of the objectives of the action plan to increase participation. Students were informed that starting that week an action plan would be implemented in their classes, which would include the following four actions:

- (1) explaining the objectives and procedures for each activity to students*
- (2) requesting student participation by name*
- (3) giving them time to reflect before participating*
- (4) requesting that students who are not paying attention participate*

After the action plan was detailed to the students, discussion was held on the topic and agreement on implementation of the proposed actions achieved. The duration of the action plan differed for the groups of students but, in any case, lasted at least one month. After the action plan was implemented in the classrooms, a survey was used in order to assess students' perceptions of the action plan. The survey included 10 items (see Table 1) to be evaluated on a Likert scale based on the extent to which the participant agreed (1 being the lowest agreement and 4 the highest agreement).

After having reflected upon the experience, the instructors that participated in this experience recorded their perceptions into writing, providing opinions on the development of the action plan, students' comments and all other additional comments.

3. Results

The action plan assessment was performed by both students and teachers.

3.1 Students' evaluation

A total of 103 students completed the survey on an anonymous basis. Of these students, 57 were enrolled in a bachelor's program in Medicine (55.3%), 20 (19.4%) in Psychology, 9 (8.7%) in Psychology and Criminology, 8 (7.8%) in Criminology, 6 (5.8%) in Education and Psychology and 3 (2.9%) in Law and Criminology. A majority of the students (92; 89.3%) were in their second year, 8 (7.8%) were in their first year and 3 (2.9%) were in their third year.

The survey results are provided in Table 1. An average and standard deviation (SD) for the score for each item was calculated.

Table 1. Survey results on student perception of the action plan

Average ± SD	
1. Do you think this intervention improved your participation?	3.01 ± 0.69
<i>On a scale of 1 to 4, how much did each of the following contribute to improving participation:</i>	
2. Clearly describing the type of participation requested	3.03 ± 0.57
3. Teacher addresses specific students by name	3.40 ± 0.78
4. Clearly describing what is expected of students as regards participation	3.20 ± 0.70
5. Teacher addresses distracted students to "help them return" to class	2.99 ± 0.95
6. Teacher allows time for reflection after posing a question	3.41 ± 0.72
7. Did you feel more comfortable participating after we implemented these measures?	2.87 ± 0.81
8. Did you find that the teacher's attitude encouraged you to participate?	3.29 ± 0.68
9. Did the class have a respectful attitude that encouraged participation?	3.30 ± 0.67
10. Did you have a respectful attitude that encouraged participation?	3.38 ± 0.72

The scores' mean was 3.19 (range:1-4), demonstrating a positive student perception of the action plan. As shown in table 1, the statements with the highest average scores were: "Teacher allows time for reflection after posing a question" and "Teacher addresses specific students by name." The statement with the lowest average score was "Did you feel more comfortable participating after we implemented these measures?" The statement with the highest variability in the responses was "Teacher addresses distracted students to 'help them return' to class."

The answers to questions 8, 9 and 10 show that teachers' and students' attitudes seem to be appropriate and respectful, which leads us to believe that this action plan was effective in improving the classroom environment.

3.2 Teachers' evaluation

The instructors that participated in this experience recorded their perceptions into writing, providing opinions on the development of the action plan, students' comments and all other additional comments. These teachers' comments were summarized into the categories shown in Table 2.

Table 2. Categorization of teachers' comments on the experience

CATEGORIES	
1.- Student comments on participation before implementing the action plan	<ul style="list-style-type: none"> - Not all teachers encourage participation - Although some instructors encourage participation, in the end, that doesn't happen because they don't provide enough time to participate - Participation is frequently requested but feedback is not provided - Teachers ask for their opinion but don't actually take it into account when making decisions - Some students stated that participation should be voluntary, because everyone is different - In general, they believe that participation is necessary and has advantages - Some students indicated that they believed inviting distracted students to participate was too harsh - Not all teachers make participation objectives clear
2.- Explanation of the procedure	<ul style="list-style-type: none"> - The various actions of the activity were described to the groups - Students discussed the action plan - Students were asked for their opinion regarding the process as a whole - Students completed a survey at the end of the activity
3.- Teacher perception of the action plan	<ul style="list-style-type: none"> - Improved the learning environment. - Improved relationships with students and the classroom environment. - Brought students and teachers closer together. - Required effort by both teachers and students. - Improved the use of class time. - Expressing our interest in their participation and gathering their opinions has a very positive effect. - Students value when teachers seek and take their opinion into account. - Fostered student satisfaction. - It's critical to explain the specific actions of the plan and make sure its objectives are clear.
4.- Effective messages to reinforce	<ul style="list-style-type: none"> - "It doesn't matter if you're wrong"

participation	<ul style="list-style-type: none"> - "The important thing is that you learn" - "Thank you for sharing your opinion"
5.- Teacher proposals to improve participation (post-action plan)	<ul style="list-style-type: none"> - A warm and nurturing environment to encourage participation must be established - Confidence must be instilled in students - Participation has to be regarded as central to active learning - Importance of errors has to be ameliorated.

4. Discussion

All in all, the action plan helped to improve student participation as evaluated by both students and instructors. It was focused on these specific actions: (1) explaining the objectives and procedures for each activity to students; (2) requesting student participation by name; (3) giving them time to reflect before participating; (4) requesting that students who are not paying attention participate.

Specifically, our results suggest that when implementing a classroom participation action plan, it is essential to clearly explain the objectives and procedures to be followed ahead of time. Discussing the actions to be implemented with students could also mean increased student engagement, as they value when their opinions are taken into account.

We also collected evidence showing that this action plan may have increased classroom participation primarily because the students perceived a caring approach of the instructor (high score on the item: "teacher addresses specific students by name"), who also provided enough time to reflect before responding (high score on the item: "teacher allows time for reflection after posing a question").

Requesting participation may have obligated students, especially those usually being distracted in the classroom, to make an effort when they were presented with new activities. For this reason, students might need time to reflect before participating. In this line, a low score for the item "Did you feel more comfortable participating after we implemented these actions?" could be a reflection of the students need for more time to internalize these actions.

In addition to a boost in student participation, this action plan produced a beneficial effect on classroom environment, which can be understood as the perception of factors related to characteristics of both teachers and the environment that provide students with the necessary security to engage in their learning. Perceptions of the relationships between students and the teacher, as well as amongst students, seemed to have gotten better in the groups where the plan was implemented. As a result, it is reasonable to think that generating an environment that promotes trust, confidence and respect for students must be

a top priority for instructors if authentic participation is to be achieved. It is worth noting, though, that implementing these actions may require extra work by teachers and students.

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An agreement-based approach for reliability assessment of Students' Evaluations of Teaching

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Abstract

Students' Evaluations of Teaching (SETs) are the most common way to measure teaching quality in Higher Education: they are assuming a strategic role in monitoring teaching quality, becoming helpful in taking the major formative and summative academic decisions. The majority of studies investigating SETs reliability focus on the instruments and the procedures adopted to collect students' evaluations rather than on the capability of the students as teaching quality assessors. In order to overcome this lack, a study has been carried out with the aim of measuring SETs reliability in terms of inter-student agreement and intra-student agreement. The results of our study show that the majority of students provided substantially repeatable evaluations whereas only a few students provided almost perfectly repeatable evaluations; the evaluations provided by different students generally slightly agreed, which means that the students did not share the same opinions and beliefs on teaching quality.

Keywords: *teaching quality assessment; reliability; inter-student agreement; intra-student agreement.*

1. Introduction

Measuring the student experience is assuming increasingly importance in Higher Education (hereafter, HE) representing a widespread method for evaluating teaching quality whose importance is relevant for taking the major formative and summative academic decisions (Berk, 2005; Gravestock & Gregor-Greenleaf, 2008; Onwuegbuzie *et al.*, 2009).

Student ratings, also known as Student Evaluations of Teaching (SETs), have dominated as the primary measure of teaching quality over the past 40 years (*e.g.*, Centra, 1979; Seldin, 1999; Emery *at al.*, 2003; Gaertner, 2014) forming the basis for the rankings of HE institutions. Although widely used, SETs are one of the most controversial and highly-debated measures of teaching quality: many researchers argue that there is no better option that provides the same sort of quantifiable and comparable data on teaching quality (McKeachie, 1997; Abrami, 2001) but, on the opposite, others point out significant biasing factors for SETs.

The fear that students cannot provide reliable teaching quality evaluations is, by far, one of the primary concerns about SETs. As a matter of fact, even highly motivated students can base their current evaluations on their past teaching experience, which can substantially vary depending on the college or university attended and/or on the student individual belief toward the degree (Ackerman *et al.*, 2009). Students who are generally satisfied/dissatisfied with the course and/or the instruction can bias the results upward/downward (Sliusarenko *et al.*, 2013). In addition, it is known that demographic (*e.g.*, gender and age; Thorpe, 2002; Fidelman, 2007; Kherfi, 2011) as well as logistic (*e.g.*, class size; Kuo, 2007) factors can influence SETs. The above considerations call into question the opportunity to consider the students as able to provide reliable evaluations on teaching quality. For this reason, differently from the majority of available studies, which rather focus on the instruments and the procedures adopted to collect SETs, our study aims at investigating the peculiar abilities of the students as teaching quality assessors by measuring SETs reliability in terms of inter-student and intra-student agreement. Particularly, the former allows evaluating the students' ability to provide the same score, on average, as the other students whereas the latter, also known as *repeatability*, allows evaluating the students' ability to score consistently a given quality item in different occasions.

2. Measuring inter-student and intra-student agreement: kappa-type indexes

The easiest approach for assessing the degree of agreement among repeated evaluations would be to simply calculate the observed agreement. This approach, however, provides a biased measure of agreement, especially when a rating scale with a few categories is adopted. In order to avoid this problem, inter-student and intra-student agreement will be assessed using the well-known kappa-type indexes, where the observed agreement is corrected for the agreement expected by chance. Specifically, the degree of inter-student

agreement is assessed by calculating the s statistic proposed by Marasini *et al.* (2014), that is a rescaled measure of the probability of observed agreement p_a^s corrected with the probability of agreement expected by chance alone p_{alc}^s :

$$s = (p_a^s - p_{alc}^s) / (1 - p_{alc}^s) \tag{1}$$

Being r the number of students who rated twice (*i.e.* replications) the same n quality items on a $k \geq 3$ points ordinal scale, r_{hi} and r_{hj} the number of students who assigned the h^{th} quality item into i^{th} and j^{th} category during first and second replication, respectively; w_{ij} the corresponding weight, introduced in order to account that some disagreements (*i.e.* on categories that are at least two steps apart) are more serious than others (*i.e.* on neighboring categories), the observed proportion of agreement and the proportion of agreement expected by chance alone can be obtained as:

$$\hat{p}_a^s = \frac{1}{n} \sum_{h=1}^n \hat{p}_h; \quad p_{alc}^s = \frac{1}{k} + \frac{1}{k^2} \sum_{i=1}^{k-1} \sum_{j=i+1}^k w_{ij} \tag{2}$$

where \hat{p}_h is the proportion of agreement on h^{th} quality item given by:

$$\hat{p}_h = \left(\sum_{i=1}^k r_{hi} (r_{hi} - 1) + 2 \sum_{i=1}^{k-1} \sum_{j=i+1}^k w_{ij} r_{hi} r_{hj} \right) / (r(r-1)) \tag{3}$$

The degree of intra-student agreement, instead, is assessed using the weighted version of Brennan-Prediger coefficient (1981) proposed by Gwet (2014), that is a rescaled measure of the probability of observed agreement p_a corrected with the probability of agreement expected by chance alone p_{alc} :

$$K_W^U = (p_a - p_{alc}) / (1 - p_{alc}) \tag{4}$$

The chance measurement system adopted in Brennan-Prediger coefficient is the uniform one. Being n the number of quality items rated twice on a $k \geq 3$ points ordinal scale by the same student, n_{ij} the number of quality items classified into i^{th} category in the first replication and into j^{th} category in the second replication, the observed proportion of agreement \hat{p}_a and the proportion of agreement expected by chance alone p_{alc} are:

$$\hat{p}_a = \sum_{i=1}^k \sum_{j=1}^1 n_{ij} w_{ij}; \quad p_{alc} = \left(\sum_{i=1}^k \sum_{j=1}^1 w_{ij} \right) / k^2 \tag{5}$$

The values of kappa-type indexes range between -1 and 1, with negative values meaning disagreement. The index magnitude can be interpreted by adopting the Landis and Koch (1977) benchmark scale. According to this scale, there are 5 categories of agreement

corresponding to as many ranges of coefficient values: slight, fair, moderate, substantial and almost perfect agreement for coefficient values ranging between 0 and 0.2, 0.21 and 0.4, and 0.41 and 0.6, 0.61 and 0.8 and 0.81 and 1.0, respectively.

3. Case Study

The case study was conducted at the Department of Industrial Engineering of University of Naples "Federico II" and consisted of 3 supervised experiments (hereafter, E.1, E.2, E.3) carried out on classes of students attending the course of Statistical Quality Control (SQC) in 3 successive academic years. All three involved classes included more than 20 students; all of them obtained the first level degree in Management Engineering from the University of Naples "Federico II" and thus they can be reasonably assumed homogeneous in curriculum and instruction.

Students were asked to fill two evaluation sheets (each with a specific rating scale) in order to collect their quality evaluation for a set of $n = 20$ items (regarding, for example, organization, workload and readings) of the SQC course they were attending. The first evaluation sheet used a Numeric Rating Scale (NRS) with scores ranging from 0 to 10 whereas the other used a Verbal Rating Scale (VRS) with agreement grades: "strongly disagreeing with the statement", "slightly agreeing with the statement", "quite agreeing with the statement" and "strongly agreeing with the statement". For comparability purposes, students' evaluations on the NRS were rescaled to the 4-points VRS using the following cut-off ranges: 0 to 2, 3 to 5, 6 to 8 and 9 to 10.

Each experiment consisted of two sessions: the first evaluation session (*i.e.*, S.I) took place at mid-term course and the second evaluation session (*i.e.*, S.II) took place the following lesson. Between S.I and S.II there was no new lesson and no interaction with the teacher, therefore no change in quality evaluation was expected. In order to guarantee evaluation traceability while preserving anonymity, each student signed her/his evaluation sheets with a nickname, which enabled to match student's ratings provided in the two evaluation sessions in order to estimate intra-student agreement. Only those students who rated all quality items in both experimental sessions were retained as participants in the study (*viz.* 17 students in E.1, 18 students in E.2 and 17 students in E.3).

The collected data were used to estimate the inter-student and intra-student agreement on NRS (hereafter, \hat{s}_{NRS} and $\hat{K}_{\text{W|NRS}}^U$, respectively) and the inter-student and intra-student agreement on VRS (hereafter, \hat{s}_{VRS} and $\hat{K}_{\text{W|VRS}}^U$); the intra-student agreement coefficients were both computed adopting the linear weighing scheme (Cicchetti & Allison, 1971).

3.1. Study results

The value of \hat{s}_{NRS} and \hat{s}_{VRS} for E.1, E.2 and E.3 are reported in Table 1.

Table 1. Inter-student agreement on NRS and VRS

Experiment	E.1	E.2	E.3
\hat{s}_{NRS}	0.395	0.300	0.600
\hat{s}_{VRS}	0.380	0.528	0.277

The results for intra-student agreement for each student participating in E.1, E.2 and E.3, are reported in Table 2 and plotted in Figures 1 against the 5 regions of intra-student agreement on NRS and intra-student agreement on VRS identified according to the Landis and Koch’s benchmark scale.

Results in Table 1 highlight that the inter-student agreement is at most moderate, so that it is not possible to assume that the involved students shared the same opinions about teaching quality; the difference between the two rating scales is irrelevant only for students of E.1, however results do not allow preferring a rating scale over the other.

The intra-student agreement was generally higher than the inter-student agreement: 73% of students were at least substantially repeatable on both NRS and VRS whereas 19% of them were even almost perfectly repeatable on both NRS and VRS. In addition, the majority of students show over the years values of $\hat{K}_{W|VRS}^U$ higher than those of $\hat{K}_{W|NRS}^U$ although for about half of them the repeatability on the two rating scales belong to the same agreement categories and only for few (*i.e.*, 10) students $\hat{K}_{W|NRS}^U$ and $\hat{K}_{W|VRS}^U$ belong to no-adjacent categories of agreement.

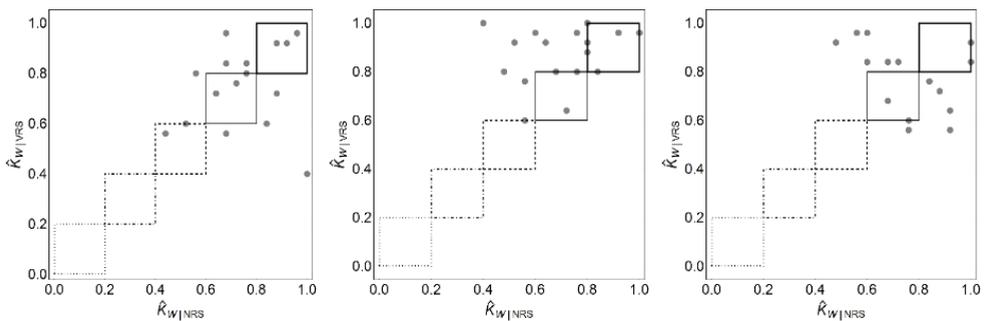


Figure 1. Intra-student agreement on NRS (as abscissa) and VRS (as ordinate) for each student participating in E.1. (on the left), E.2. (in the middle) and E.3. (on the right)

Table 2. Intra-student agreement on NRS ($\hat{K}_{W|NRS}^U$) and VRS ($\hat{K}_{W|VRS}^U$)

Student	E.1		E.2		E.3	
	$\hat{K}_{W NRS}^U$	$\hat{K}_{W VRS}^U$	$\hat{K}_{W NRS}^U$	$\hat{K}_{W VRS}^U$	$\hat{K}_{W NRS}^U$	$\hat{K}_{W VRS}^U$
1	0.76	0.80	0.56	0.76	0.92	0.56
2	0.88	0.72	0.80	0.92	0.56	0.96
3	0.68	0.96	0.48	0.80	0.72	0.84
4	1.00	0.40	0.84	0.80	0.60	0.96
5	0.68	0.84	0.52	0.92	0.84	0.76
6	0.76	0.84	1.00	0.96	0.88	0.72
7	0.92	0.92	0.64	0.92	0.68	0.68
8	0.96	0.96	0.76	0.80	0.68	0.84
9	0.64	0.72	0.60	0.96	0.60	0.84
10	0.44	0.56	1.00	0.96	0.76	0.60
11	0.72	0.76	0.56	0.60	0.48	0.92
12	0.84	0.60	0.92	0.96	0.92	0.64
13	0.76	0.84	0.80	1.00	0.72	0.84
14	0.56	0.80	0.72	0.64	0.76	0.56
15	0.68	0.56	0.80	0.88	1.00	0.84
16	0.52	0.60	0.68	0.80	1.00	0.92
17	0.88	0.92	0.40	1.00	1.00	0.92
18			0.76	0.96		

4. Conclusions

This research aimed at investigating the reliability of Students' Evaluations of Teaching by evaluating intra- and inter-student agreement.

With respect to intra-rater agreement, the results of our study highlight that, on average, the 65% of involved students could be considered repeatable assessors of teaching quality, since they provided quality evaluations that were consistent over time. Specifically, for NRS, the percentage of at least substantially repeatable students ranges, across the three experiments, between 66% and 82%, whereas, for VRS, the percentage of at least substantially repeatable students ranges between 71% and 94%. These results seem to suggest that even if the NRS is the most common rating scale, the students were able to express their opinion more consistently using a verbal rather than a numeric rating scale.

On the other hand, focusing on inter-student agreement, results seem to suggest that the whole class of students could not be considered homogeneous in terms of beliefs and/or opinions and/or knowledge about teaching quality, being the inter-student agreement at most moderate, independently of the specific class of students and the adopted rating scale.

The obtained results cannot of course be generalized since, although the experiments were repeated over three academic years, they involved only students attending the same course. In order to overcome this weakness, an interesting development could be to conduct the same experiment on different university courses.

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Are pre-service Primary School teachers prepared to teach science by inquiry?

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Abstract

Inquiry-based science education (IBSE) focuses on the development of science process skills. This teaching methodology has been shown to be especially effective during Primary School as it allows children to explore and confront their own ideas about Nature. Also, a methodology based on process skills is coherent with the main purpose of this educational stage where children need to learn to do things. In order to implement a methodology based on science process skills Primary teachers need to know to use science process skills, and how to teach them. In this paper we address whether Spanish pre-service teachers are able to implement IBSE. We focus on pre-service Primary School teachers and compare our results with in-service teachers and a random sample of non-teachers. We explore their level of knowledge about science process skills and if pre-service teachers know how to develop an inquiry-based learning sequence. An overview of the situation of science education and teaching of scientific skills among the degrees on Primary Education in Spain is also presented. Our results show that pre-service teachers have a lack of knowledge on science process skills and fail when they attempting to build a learning sequence based on inquiry.

Keywords: *Inquiry-based science; university education; science process skills.*

1. Introduction

The teaching of science by inquiry (IBSE: Inquiry-based science education) incorporates the science process skills as part of the learning process (Harlen & Qualter, 2009; Minner *et al.*, 2010). Students, besides learning science concepts, learn to make observations and hypothesis, to build experiments and fair tests, to identify the different variables that affect a phenomenon, to measure, to extract conclusions from data, etc. Including scientific skills in the learning process is coherent with the nature of science, and it is specially recommended in Primary School for two reasons (Harlen & Qualter, 2009): first, children are allowed to test their own ideas about Nature. Children's ideas are sometimes misaligned with the scientific ideas, as they tend to be strongly biased by their sensory experience. An educational strategy like IBSE provides opportunities to confront their experience with evidence, which is key to overcome science misconceptions and develop a critical thinking. Second, children need to learn through action, they need hands-on activities to understand. Also, a methodology based on process skills is coherent with the main purpose of this educational stage where children need to learn to do things.

To implement a methodology based on science process skills teachers should know, first, science process skills, and second, how to teach them. This two-step level on inquiry-based science teaching is not easy to achieve and requires University programmes properly focused for that; even more if the level of pre-service teachers' science education is low when they start the degree (Crawford, 1999). There are studies stressing the fact that very few teachers (among the most motivated) teach science by inquiry or relate contents to the nature of science (Capps & Crawford, 2013). Actually, many teachers think they do it when in fact they do not (Capps & Crawford, 2013; Oppong-Nuako *et al.*, 2015). This shows confusion at a pedagogical level, coming in part from teachers' education at University. Programmes seem to be far to provide a proper education for teachers on inquiry. This has been barely investigated in Spain (Cañal de León *et al.*, 2013; García-Carmona *et al.*, 2016) and it is important to do research on both steps: What is the level of knowledge of teachers about science process skills? Do teachers know how to teach them? In this study we aim to investigate on those questions focusing on pre-service Primary School teachers' education.

In this work, we analyze what is the level of knowledge of pre-service teachers about science process skills from middle courses at University. We compare the results with in-service teachers and a random sample of non-teachers. On the other hand, we analyze how is the structure of teaching sequences proposed by pre-service teachers that already took a course on science teaching. Finally, we give a general overview of Spanish Teachers' Education Faculties about inquiry. The goal is, first, to evaluate whether pre-service teachers have a good level of knowledge of science process skills and, second, whether they know how to build a teaching science by inquiry or whether the teaching sequences contain any inquiry skills in their educational context.

2. Methodology

There are several tests that measure the level of knowledge of science process skills (Monde-Monica, 2005; Miles, 2010; Shahali *et al.*, 2015), both for teachers and students, and from primary and secondary school. The *Test of integrated process skills* (TIPS and TIPS II) (Burns *et al.*, 1985; Dillashaw & Okey, 1980) has been validated and used in many studies for that purpose. In this study we used the TIPS II test (Burns *et al.*, 1985) that is a multichoice questionnaire that measures five science process skills: (a) making operational definitions based on a description of an investigation (6 questions), (b) identify the manipulated, responding and controlled variables (12 questions), (c) state hypothesis based on a description of variables involved in an investigation (9 questions), (d) interpret data and graphs (6 questions), and (e) given a hypothesis, design an investigation to test it (3 questions). The test was administered to a convenience group of 110 pre-service Primary teachers of 2nd and 3rd course (out of 4) at the Teachers' Education Faculty at University of Valencia. All of them had attended a course on general science contents, but they had not attended any course on science teaching yet. Age, gender and secondary school itinerary (sciences, social sciences, humanities/arts or technical studies) were also registered. Additionally the test was administered to a convenience group of 16 in-service teachers, and to a random sample of 26 of non-teachers. In the case of the random sample, the higher education degree they hold was also registered as well as a self-assessment about their science knowledge (0 to 10 scale).

We have also analyzed nine teaching sequences proposed by 43 students in groups of 4/5 people that already took a course on science teaching in the same Faculty. They were asked to build a teaching sequence using the IBSE approach about a concept related to the topic *The fruit and the seed*. They had 45 minutes to do it. To evaluate the teaching sequences we assessed whether the set of activities work on the following items with children: (1) observation, (2) making hypothesis and predictions, (3) designing an experiment, (4) building conclusions from data and (5) whether the set of activities involving process skills drives to conclusions about a particular concept. For each item, a set of minimum requirements was defined: (1) Classification and grouping of features. Sharing observations in small groups and/or the whole class. Categorization and prioritization of observations. (2) Providing opportunities and time for children to think how different observations are related, and suggesting hypothesis to explain them. Choosing one or some hypothesis (statements) to analyse. (3) Planning a detailed research (e.g. what and how to measure, what materials and instruments are needed, what to do step by step). Identifying the variables that should be varied and controlled. Planning a fair test. (4) Showing and interpreting data according to the proposed hypothesis. Analysing the limitations of the experiment. (5) Does the observation scenario show the variables that children need to detect to build hypothesis? Do the set activities drive children to propose proper

experiments related to the phenomenon? Is the concept (or set of concepts) clear at the end of activities?

Finally, we looked at the programmes of 21 Teachers' Education Faculties in Spain to see the distribution of subjects and hours per subject related to general science and science teaching courses. Besides, we looked for some keywords related to inquiry on the 83 teaching guides of those subjects: "inquiry", "observation", "hypothesis", "identify variables", "interpret data", "graph", "design investigations" and "design experiments". We checked the context where they were found in cases of doubt.

3. Results and discussion

The age of participants varied from 19 to 21 years old in pre-service teacher, to 41.4 (19 to 67) years old on average in the non-teachers sample. In-service teachers have on average 31.9 (24 to 58) years old and 16.25 (1 to 35) years of teaching experience. Gender distribution varied from 80% women in pre-service teachers, 93% in in-service teachers and 39% in the non-teacher sample. 87% of pre-service teacher come from a non-science itinerary in secondary school. 43% of non-teachers sample have had a science-oriented education, 85% hold a university degree and on average they feel that their scientific knowledge is of 5.7 out of 10.

3.1. Level of knowledge on science process skills

The average frequency of correct answers in pre-service teachers is 0.64 ± 0.13 (mean \pm standard deviation), almost like in-service teachers 0.66 ± 0.17 and lower than in the non-teacher group 0.75 ± 0.11 . These differences are statistically significant between pre/in-service teachers and non-teachers (Student's t-test p -value < 0.001). In the non-teachers group, average frequency of correct answers is higher either if they have had a science-oriented education (0.78) or not (0.73) and is not correlated with their self-perception of their level of science knowledge. Test failure rate (i.e., frequency of correct answers lower than 0.5) is very low. Only 14% of pre-service teachers fail, more or less the same as in-service teachers (19%) whereas nobody in the non-teacher group fails. However, high scores rates are very low too. Only 2% of pre-service teachers have correct answers' frequencies higher than 0.85 (6% for in-service teachers and 22% for non-teachers).

There are no differences between pre-service teachers' scores depending on their secondary school itinerary (ANOVA p -value = 0.162). Students coming from sciences do not score significantly better than the others. However, there are significant differences between pre-service teachers' scores depending on the course (Student's t-test p -value < 0.001). The average frequency of correct answers in students from the 2nd course is 0.57 ± 0.12 , while for the students from the 3rd course is 0.69 ± 0.11 . These differences could be due to the fact that students in 3rd course are grouped based on their grades, whereas in 2nd course they are not

sorted. In our sample, the participating students of 3rd course likely came from groups with higher grades. In any case, differences between pre-service teachers, and in-service and non-teachers samples hold either when grouping all pre-service teachers together or when they are split by course.

Results are different for the five different groups of questions addressing different science skills. Pre-service and in-service teachers score worse than non-teachers in all groups of questions, but these differences are only statistically significant in questions related to identify types of variables (group 1), make operational definitions (group 2) and state hypothesis (group 3). In group 2 of questions, pre-service teachers score significantly worse than the other two samples, while in groups 1 and 3 both pre-service and in-service teachers score significantly worse than non-teachers. The group of questions with the lowest score is that related to identify variables (group 1). Particularly, those questions addressed to the identification of manipulated and controlled variables (only 25% or less give the correct answer). Regarding to the formulation of hypothesis (group 3), pre-service teachers are able to identify the hypothesis when a detailed investigation is provided, however they get worse results when a more open description of an investigation is provided. The same trend is found in in-service and non-teachers groups.

In general, pre-service teachers' answers show low correlation within group of questions (Cramer's $V < 0.5$ in all groups). The lowest correlation is found in group 3 (Cramer's $V=0.15$), probably due to the different ways of asking about hypothesis building (commented above). Results are very similar when in-service teachers and non-teachers are included in the sample.

3.2. Level of inquiry in science teaching sequences

Nine teaching sequences about a concept related to the topic *The fruit and the seeds* were prepared by 43 students working in groups of 4/5 people. Students were asked to use an inquiry-based approach, however the level of inquiry in all those sequences is very low. None of the sequences presents anything related to designing experiments (items 3) nor building conclusions from any data (item 4). Activities do not show a clear concept to be investigated, and there are not a series of steps to guide children through the investigation (item 5). In some of them, observation (item 1) is worked, but the level of training of this process skill (classification, association, hierarchical organization of the observed items, etc.) is very low. In all cases, there is only a general wording saying something like "observe *this* and tell me what you see". There are no guidelines to make the observations, the scenario is not specified and the purpose is not clear. There are three cases where the observation is done after an explanation of the concept that is (presumably) being investigated: "After explaining what are the parts of a fruit and their functions, we ask the children to identify them on some real fruits". So, the main purpose of the observation

process skill (distinguish features to build hypothesis from them) is lost. There is only one case where they work partially on building hypothesis, although without a proper previous observation scenario, so the activity is too rough. Besides, it ends up saying “the teacher guides the debate to the true hypothesis by reasoning with children”, blocking any investigation from there. The general structure of the teaching sequences consists in a first part of making questions to children or proposing a general observation and then explaining the concept. There are only two cases where they propose to do “an experiment” after the first part. But this experiment is completely demonstrative (just to check the previous explanation) and is not a part of an investigation. There are two other cases where, after a first part, they say “and now we would do an investigation by working in the school’s vegetable garden” or “and now we would do a research project about this”, but they do not specify how.

It is surprising the level of incoherence among the activities of the same sequence according to a proper IBSE approach. Students do not seem to know the general structure of teaching sequences based on inquiry nor how to work on process skills and concepts at the same time. It is also striking the lack of theoretical background. Most of the teaching sequences contain misconceptions, error or teleological arguments like “fruits provide us vitamins and that is why they are edible. That is one of their functions”. This shows a clear problem of resources in the process of building teaching sequences.

3.3. Science education and inquiry on Primary Teacher degrees

The curriculum of Primary Teacher degree in Spanish Education Faculties typically includes between two and four mandatory subjects related to science education. Most of these subjects (68.5%) take 60 hours. Three kinds of subjects can be found: general courses on basic contents of science (C), courses on didactics of science (T), and courses that combine both, that is general science contents and didactics of science (CT). C subjects tend to be taught in the first years (1st and 2nd year), only science subjects covering specialized contents are taught in the last years (3rd and 4th). T subjects are mainly taught in the last years (3rd and 4th), and CT subjects in the middle years (2nd and 3rd). The search of inquiry-related keywords on 83 teaching guides corresponding to mandatory and non-mandatory subjects shows that the rate of appearance of inquiry terms is very low. “Observation” is the keyword with a higher rate of appearance, it appears in 26.5% of the guides with a frequency of 0.26 times per guide. “Interpret data”, “inquiry” and “hypothesis” appear 0.18, 0.12 and 0.10 times per guide respectively. The rest of the keywords are either absent or only appear one time. Globally, our results show that the presence of inquiry at University science teaching programmes is very scarce.

4. Conclusions

Teaching science by inquiry in Primary School is one of the big challenges in science education since many years ago. There are countries (USA, France, UK, Finland, etc.) that have already implemented these programmes with some successes and limitations. One of the main obstacles is the education of pre-service teachers. Students of Primary Teacher degrees require to train their science process skills, and learn how to teach them to children. In Spain, the introduction of inquiry-based science in Primary Schools is either rare or incipient. Our results show that education of pre-service teachers is not promising to reverse this situation. Presence of inquiry and inquiry skills in subjects covering science contents and didactics of science in the Primary Teacher degrees in Spain is very limited. Despite having low failing rates in the TIPSII, pre/in-service teachers score lower than non-teachers. Pre-service teachers fail in questions deeply related to science process skills that are not typically covered in other subjects, like maths. They fail on identifying variables when building an experiment, on making hypothesis and finding operational definitions. Primary teacher students also fail on doing teaching sequences by inquiry. Only observation is worked in some cases. Activities do not follow the logical development of a research, and the goal of the sequence is not clear. Overall, our results show the need to strengthen the training in science process skills of future Primary teachers. This situation inevitably involves reinforcing and improving curricula of science subject of Primary Teacher degrees.

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An innovative cooperative model for the Master Degree Project of Architecture. Overcoming the traditional system.

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Abstract

Although the Bologna's process has highlighted the need to develop deep and structural changes in the educational institutions, there is a scarce bibliography on innovation projects in Master Degree Projects, specifically in the field of Architecture. This paper is part of a educational innovative reaserch project that is proposing a cooperative process-and-product model-based for MDP. The model is developed in three stages, from collaborative learning action groups to individual project. At the end of the process the student has developed three documents: a presentation, a product and a daily-portfolio. Finally, MDP assessment is the sum of three evaluations.

Keywords: *Master Degree Project; Architecture; Cooperative learning*

1. Introduction

The Master Degree Project (MDP) is the normal exercise of a Master of Architecture (MArch) Thesis in Spain. It is presented as a propitious time for students to turn around and demonstrate their professional training, at the end of their initial training process. Although the Bologna's process has highlighted the need to develop deep and structural changes in the educational institutions, there is a scarce bibliography on innovation projects in MDP, specifically in the field of Architecture. This paper is part of a educational innovative reaserch project developed in the School of Architecture of Málaga University¹ that is proposing a cooperative model-based for MDP. Since 2010, the MArch is replacing the Bachelor of Architecture (BArch), and the MDP is replacing the Bachelor Degree Project (BDP). In both cases, the Spanish educational law states two clear conditions:

a) Presentation and defense of an original exercise carried out individually, before a university defence committee that must include at least one professional of recognized prestige proposed by the professional organizations.

b) Elaboration of an integral architectural project of a professional nature in which all the competences acquired in the career are synthesized, developed to the point of demonstrating sufficiency to determine the complete execution of the building works on which to see, with compliance of the applicable technical and administrative regulations.

The students' relationship with the MDP/BDP can be considered 'special' and exceptional regarding other Bachelor of Science in Engineering. In Architecture, the temporal duration of 30 ECTS (one semester) is one of the highest in technical degrees. Although there is no data to confirm this, an MDP/BDP done in one semester is a very rare practice because students spend more than one semester to complete it (even one or two years). By other hand, students leave a learning model, in which the same professor teaches, puts objectives and evaluates them. In MDP, the advisor (or tutor) replaces the professor's role, and students have to plan their own work schedule and objectives. This new situation has negative pedagogical consequences:

a) There is a contradiction in the 'individual' realization of a MDP. While the professional and research world tends to create multidisciplinary work teams, the individual figure of the architect is insisted on as creator and generator of the project.

b) The sole examination done by a 'defence committee' is an obsolete model (Iborra, 2011). It is imported from the Doctorate's degree where the number of students is normally reduced and has difficulties of application in Bachelor's or Master's degrees with a large

¹ PIE-15-146 Collaborative educational innovation actions for the tutoring of Master's Thesis (2015-17).

number of students. In this case, the committee has serious problems to study and assess a big amount of MDPs.

c) In regard to ‘elaboration of an integral project of architecture of professional nature’. There are problems to define the terms ‘integral project’ and ‘professional nature’. A professional project of architecture is a work made according to norms of presentation marked by the local Official Architect’s Association and limited by the normative compliance of the legislation in a wide spectrum: urban regulations, building law, and technical norms. The project comprises memories, plans, technical specifications, budgets and annexes, regardless of the elaboration of models, given the legal implications that the professional work has.

1.2. Literature

Due to the influence of the professional world, MDP has traditionally focused on the final-product result, however, in the academic and teaching field, the product is the result of a learning process. According to Rekalde Rodríguez (2011), conception, design, development and evaluation of MDP should be conceived as a learning process where the Master degree’s competences are integrated and visualized. Thus, MDP needs to adopt a more proactive role to overcome four constraints:

(a) Overcoming the time: the MDP before the MDP.

Iborra (2011) proposes to carry out the BDP/MDP in parallel with the degree itself, from the moment a student is enrolled in the first course, although it is present or integrated at the end of the process. This model collides with the assumed idea that one first know and then apply what is known, replacing it with the idea that ‘we learn from our practical experience’.

(b) Overcoming individual work: a Cooperative-learning Action Group (CAG).

The MDP model should follow an PBL (problem-based learning) methodology defined by Barrows (1986) as a pupil-centered self-directed learning model that occurs in small groups, where advisors (or tutors) act as facilitators of the learning process. For this reason, the creation of groups of five to eight people (Exley and Dennick, 2007) at the beginning of MDP can have a very positive effect. In the advantages of group work, Benito and Cruz (2005) point out that imagination, creativity, and experience is favored. Small size groups encourage collective spirit and motivation. It allows developing different approaches to the problems. While the main drawbacks are personal and/or potential conflicts of interest for sharing information about a project that is known to end individually.

The incorporation of a 'cooperative learning' in the PBL methodology adds a situation of equality and collaboration in the conditions of the group. According to Deutsch (1949:21): *"a cooperative social situation is one in which the goals of the separated individuals are so united that there is a positive correlation between the attainment and their goals, in such a way that an individual achieves his goal if and only if the other participants also achieve theirs"*.

Within the framework of these cooperative groups, Rekalde Rodríguez (2011) proposes the Learning Group in Action (LGA). A concept based on MC Gill and Beaty (1995)'s studies, where each student *"develops study in group, respecting the rules of confidentiality, respect and collective commitment. In this context, the functions that the tutor must develop will be, among others: (a) to favor systematic and argumentative reflection; (b) stimulate the search for research resources; (c) promote the analysis leading to the learning of the situations lived and ensure respect for the group itself"*. This is feasible, since the student's satisfaction with the advisor is high in the technical careers (Álamo et al., 2011), in addition, the LGA is characterized by an advisor-group interaction for planning the meetings, defining the themes, which are not imposed by the advisor but agreed by both.

(c) Overcoming the format: the digital platforms to integrate process and product.

However, the progressive incorporation of the BIM (Building Information Modeling) is assuming a renovation in the way of presenting a project. The BIM not only involves the virtual modeling of the building and its connection to the database, but also understand that the project is not a closed document to become an open platform where the different agents involved in the construction interact, along the building's life cycle.

In addition, we are immersed in a digital literacy (Prensky, 2001), therefore, it should be encouraged to present the documentation from the Multimedia, that is, by managing all the resources that allow us both to explain the process and explain the product. According to Iborra (2011) the development of video montages, audio, images, blogs, wikis, videoblogs, recordings of activities carried out that could be presented as evidence of the competencies developed, could complement the presentation of a written work defended orally before a committee.

(d) Overcoming the evaluation.

Authors such as Bonilla Priego, Fuentes Moraleda, Vacas Guerrero, & Vacas Guerrero, (2012) propose a double assessment by the advisor and the committee through a series of indicators depending on the competencies that must be acquired. This means that the committee focuses on the final product (the project) evaluation, while the advisor focuses on the process (the portfolio) evaluation. Even the cooperative phases can include students' self-assessments or co-assessments.

2. A New Process-and-product Model for MDP

From this new perspective, the proposed process-and-product model (see Fig. 1) divides the MDP into two aspects: the learning process (the portfolio) and the final product (the project). The learning process takes place in four phases: the collaborative process, the individual process, the evaluation and the dissemination of results. In this way, what is finally given is an individual exercise but with a group work support.

(1) At the collaborative process (first semester), the students are organized in several CAGs led by one or several advisors. They analyse the society needs of the selected study area. At the end of this stage, students must individually define the objectives of their project, the study area where each student will develop his individual project, with a definition of the program.

(2) At the individual process (second semester), each student develops his individual project-product guided by the advisor. The student must also prepare a work portfolio collecting all the evidences of his work process.

(3) At the evaluation stage, the student must prepare a presentation to support the defense of his project. In this way, at the end of the process the student has developed three documents: a presentation, a product and a daily-portfolio. MDP assessment is the sum of three evaluations, whose weight [A, B, C] will be determined according to the characteristics of the project:

- a) The committee's assessment of the student's public presentation and defence [weight A].
- b) The committee's assessment of the MDP as a product [weight B].
- c) The advisor's assessment of the MDP as a learning process [weight C]. Instruments and evidences of learning may be based on:
 - Design and development of MPD
 - Portfolio through the learning diary or logbook
 - Self-assessment and co-evaluation

(4) Finally, the results of the MPD will be included on the university repository.

3. Discussion and conclusion

As Iborra (2011) proposes, the MDP model is developed at the beginning of Master's degree, in a pedagogical environment that starts from the collaborative work and concludes with an individual project, according to what is required by the Spanish state regulations. It is a model in which the student is closer to a group work environment at the beginning and proposes an environment of individual creativity at the end. However, the individual result is part of the overall and collaborative response to the study area, so the model does not support different areas or another thematics proposed individually by a student.

The incorporation of the portfolio is related to the MDP research process and, according to the experience of Barragán Sánchez (2005), facilitates the evaluation of the process and the product, motivating the student in the reflection on the learning process and developing collaborative skills. However, the proposed model has some drawbacks: first, the adviser's work increases considerably, and secondly, the evaluation becomes a complex process. Therefore, the proposal needs a practical application to assess the improvements proposed.

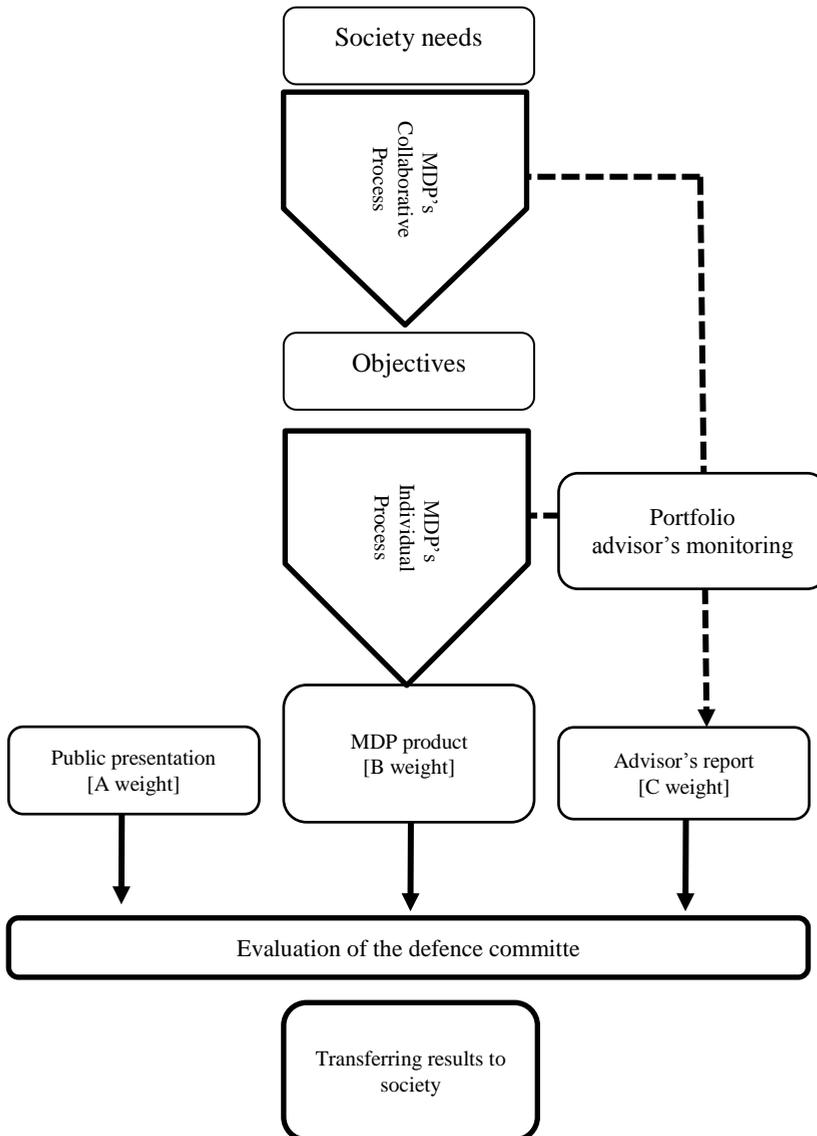


Figure 1. A cooperative model for a MDP of Architecture. Source: Authors (2017).

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Use of LinkedIn in teaching and labour monitoring of the Master in Hotel Companies Management

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Abstract

The present paper explores the use of the professional social network LinkedIn in the teaching of official masters. It is based on two projects of teaching innovation that are based on the information contained in the alumni profiles of the Master in Hotel Companies Management of the Complutense University of Madrid. Thanks to its analysis, valuable information about the insertion and career of the master's graduates is obtained, while it implies a greater interrelation between the academic and labour world. In this way, the quality of the teaching-learning process can be verified and improved with the approach of the labour world and the incorporation of the experiences of alumni to the classroom as an enrichment of regulated teaching.

Keywords: *LinkedIn, social networks, masters, graduates, job placement.*

1. Introduction

At present, the use of social networks has become an essential communication tool in the professional world that can not left out the university, and much less the teaching reality in master's degrees. For this reason, it is interesting and essential to explore which social networks are the most appropriate to foster the labor insertion of the master's students. Among the social networks in the 2.0 environment, it is worth highlighting the professional network LinkedIn as a pioneer in its applications to bring professionals in touch.

Within the Master in Hotel Companies Management of the Complutense University of Madrid, the need to promote the knowledge and the use of this network as a facilitator for the labor insertion of its students has been detected.

Given this need, and considering it essential as part of the competencies to be achieved in the program, several teachers of the master took the initiative to develop an educational innovation project to explore this field. As a result of this concern, the project "Utilization of the LinkedIn social network for academic and professional purposes for students of the Master in Hotel Companies Management" (Babinger et al., 2015) was developed which the objective to create a profile of the Master in Hotel Companies Management in LinkedIn with an associated group.

The specific objectives of the project were its diffusion:

- Among the teachers who teach classes in the master's degree, expandable to all teachers who have concordant interests in the Complutense University of Madrid.
- Both current and former students of the master, so that they could benefit from existing contacts.
- To other professionals who share the same concerns, through network operation itself.

Both teachers and students could be added to the created group, while it was open to anyone to enrich mutual knowledge and the flow of information and ideas.

The objective was to use it as a permanent communication channel with new and old students, in which news, reports and any other information of interest were posted while it could also serve as an additional channel of possible job offers for students by improving their network.

Following the good results achieved in this project, the opportunity was raised to develop a second educational innovation project entitled "Analysis and follow-up of the insertion and trajectory of the graduates of the Master Hotel Companies Management of the Complutense University of Madrid" (Innova-Docencia, No. 110, 2016-2017), which is currently being implemented and presented in this communication.

2. Background

The LinkedIn network provides benefits to both students, who are looking for job opportunities after their education, and to companies, as it allows them to manage the search for potential candidates in an agile and efficient way.

Some of the reasons why the use of LinkedIn is essential in the work placement of students are, among others: the visibility it provides to users, network creation, access to current job information, personal brand generation and the power to consume content generated by its own network and related to its professional activity. All of this provides students with a direct, effective, free or low-cost contact with labour world.

The use of the LinkedIn network is, therefore, a fundamental training tool for the students since it gives them the possibility of entering labour work in a direct and simple way.

With regard to companies, and taking as reference Chiavenato (2011), the management of the HR system in a company is integrated by basic processes such as recruitment and selection of staff, job design, incentive system and remuneration, the development of employees' professional careers and the evaluation of people, among others.

Within this management, the process of recruitment and selection of candidates is the fundamental process on which other processes pivot, since if the selection and recruitment are not carried out in an adequate way, it is difficult for the HR system to develop candidate, implement the incentive system, etc. Therefore, all these processes will depend on it (Bretones & Rodríguez, 2008) and the company must invest in the necessary resources.

Due to this, the companies, immersed in a globalized and very competitive environment, strive to attract the talent, using for this the use of new technologies of the information and communication, through Internet, optimizing this process (González, 2005) .

In a study by Deloitte (2009), it was identified that 23% of companies were already using social networks in their recruitment and selection process, and according to a study by Media Bistro (2014) the number of active LinkedIn users in the world is 270 million.

According to the aforementioned study, 45% of LinkedIn users use it daily, having helped 64% of users to develop their professional career. Regarding companies, 80% use the LinkedIn network to attract new talent.

We are therefore faced with an inevitable e-recruitment, and students, especially postgraduate ones, must be trained to act in this environment (Rico, 2015).

According to the International Labor Organization (ILO) employability is "the ability to secure and retain employment: to tune into the labor market, to be able to change jobs without difficulty or to find a job" (International Labor Organization Work, 2014). In

addition, the selection of personnel is one of the main functions by which an organization chooses from among a list of candidates the person who best meets the criteria required to fill the available position, taking into account the current human resources market conditions (Werther & Davis, 2008). The LinkedIn social network is therefore an appropriate tool for employability and selection of staff.

3. Methodology

The method used in the innovation and improvement of teaching quality projects is fundamentally qualitative, through the exploration of information published by users, in this case of alumni of the master, in the LinkedIn network. Subsequently, and after carrying out an organization of the information, it is analyzed statistically by means of a descriptive process applied to the totality of the data obtained. The method to be followed is to obtain frequencies and represent them by means of histograms, performing a statistical analysis by correspondences, to detect whether or not there are some dominant variables in the labor insertion of graduates.

3.1. Process

Prior to the implementation of the project, the research team, of an interdisciplinary nature, thought it appropriate to be enriched by representatives of the administration and services staff and students of the master's degree, in order to achieve a broader focus on the subject.

The procedure designed for the present research, includes the search and exploration of the master alumni profiles in LinkedIn, for which the work carried out in the previous project is essential. In its development, the network was used as a platform of students, so that it was possible to contact all students of previous promotions with an updated database.

This resulted in the establishment of a professional network of new and old students, teachers, professionals, institutions and companies that broadened the contacts of all of them and resulted in a new way of applying social networks to the teaching of professional masters.

The project currently under way, and with the aim of knowing the insertion and career of the students of the master's degree, specifically analyzes where they currently work, from when they do it and in what work position they are. Also considered is their career if they have worked in several companies, the time they have taken to find their first job and if it is related to the degree. Finally, given the diversity of the master's degree, we want to investigate whether there are differences by gender and nationality in the achievement of quality work.

4. Results

First of all it should be mentioned that this is a project that is currently in the development phase, so quantum results can not yet be offered as a whole. However, it should be noted that all the graduates of the master's degree have been contacted, 261 students in total, who have joined the master's network and from which the necessary information for the present project is being obtained.

The expected results are not limited to knowing the work environment in which the alumni are located, but to have a background that includes the verification of the quality of teaching to elucidate the extent to which the teaching offered in the master is useful for their professional future.

The Master in Hotel Companies Management of the Complutense University of Madrid is a degree that has as its main challenge the education of highly trained professionals. Therefore, it is understood that an effective labor insertion in companies of the sector could be used to corroborate the quality and usefulness of the offered teaching.

Knowing this scenario, it would be possible to evaluate if the learning contained in the curricula is adapted to the graduates' work reality and to propose changes and appropriate modifications that result in the improvement of the teaching quality.

In addition, the project also aims to strengthen the use of the network created in a bidirectional way: not only to facilitate the incorporation of students into labour world, but also to add the professional sector to teaching the master. This would take advantage of the contacts created, to organize activities such as continuity programs that would include visits to companies where former students work, invitations to give talks, conferences or seminars and to participate in round tables.

5. Conclusions

The LinkedIn professional network can be considered a good complement to the regulated teaching in the masters to achieve a greater interrelation between the academic and labour world. However, it has been detected that this relationship is still insufficiently internalized, which shows the need to intensify its use in master's degrees.

The results of the detailed analysis of the work trajectories followed by the different nationalities that make up the master's students will allow a personalized attention to both foreign and national students, whether they are currently studying the master's degree or those who study in a future

Based on established contacts, a specific network of old and new students can be created with whom to organize concrete and periodic activities for the labor insertion. This network promotes the recommendations among the graduates and improves the teaching quality of the master to know the real work needs of the graduates.

So the main conclusion of the ongoing project, beyond the results being analyzed at present, is the positive impact for the teaching-learning process with the incorporation of alumni experiences in the classroom, as an enrichment of regulated teaching.

On the other hand, an additional conclusion of the research is its applicability to other degrees, since the relation with the labour market is established without doubt, independently of the branch of knowledge.

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Representation of the Student-Centred Learning Approach on University Website

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Abstract

The topicality of the change of the educational paradigms in the national and global context forms a necessity and challenge for the higher education system to undergo the dynamic change in moving towards more individualised education process. The student-centred learning (SCL) approach as a topical form of implementation of the educational process conforms to the needs of contemporary society and as such advances growth at both individual as well as institutional level. The University website provides an insight into the implementation of the educational process by representing the mindset, values, and positions of individuals at the University. The aim of the research is to evaluate the representation of SCL approach on the Rīga Stradiņš University (RSU) website, thus offering conclusions and recommendations for its development. The results from the analysis of the descriptions of study programmes confirm that the representation of student-centred approach is taking place, however, it should be improved in such aspects as students' and lecturers' relationships, lecturers' competencies, implementation of the partnership, and the digitalisation of the study process.

Keywords: *Student-centred learning; university website; representation.*

1. Introduction

In recent years, educational paradigms experience more gradual worldwide changes. Alongside the shift from the *instruction paradigm* to the *learning paradigm*, the mission and aim, criteria of achievements and structures of learning/teaching in the higher education have been restructured (Barr, Tagg, 1995). More often in education documents, research and in practice the topicality of SCL approach is emphasized (European Commission, 2013; The European Students' Union, Education International, 2011; UNESCO, 2010; Prensky, 2001). The institutional policy of European Universities emphasizes that the SCL approach both improves the study process and results and provides background to the sustainable development of universities (Sursock, 2015). By placing the student in the centre of the learning process, this model of studies complies with the nowadays needs of students and society (Froyd, Simpson, 2010).

However, the implementation of SCL alongside with the digitalization advances the development of institution and individual, as well as presents unexperienced challenges. As the content of digital space enlarges the audience becomes more competent and consequently, demanding. The university's website is one of the digital aspects used to modernize education system in macro level (Diminikou, 2013), becoming a significant platform for representation. The research problem is the inconsistency between ambition to integrate SCL in the learning process and its representation on the University website. The aim of the research is to explore evidence of the SCL approach in RSU website and to work out recommendations to improve the representation of the SCL approach. Therefore the main research question is: how the SCL is represented on the RSU website and how to improve it?

2. SCL Approach

One of the main advantages of the SCL approach is the conviction that learning is no more a "one-direction process" – from lecturers to students (Robinson, Neergaard, et al., 2016; European Students' Union, Education International, 2011; Froyd, Simpson, 2010). The transformative learning is intended to improve students' skills by enhancing critical competencies (European Students' Union, 2015; European Students' Union, Education International, 2011). The organization of studies and the study process are focused on students' needs by persuading them to become more responsible and by diminishing their dependence on lecturers, other students and administration (Spooner, 2015). In such study approach students have an influence on the content, activities, materials and learning process in general. Lecturer becomes a coordinator, assistant in the study process and instructor who offers a possibility to learn from one another and individually, as well as develops effective learning skills. (Spooner, 2015; Froyd, Simpson, 2010) To achieve the

aim of changing the process of knowledge creation, during lectures, students mainly create new comprehension of materials studied thus implementing a new proactive approach to knowledge construction (Spooner, 2015; Haber-Curran, Tillapaugh, 2015).

The integration of information technologies in the study process and digital literacy, which are currently undervalued, play a significant role in implementation of the changes in the process of knowledge creation (Walton, 2016). The SCL model is an effective framework for meaningful ICT knowledge and vice-versa (Scheuermann, Pedro, 2009). Integration of ICT in the study process is one of the tools for implementing the SCL approach by simultaneously developing the technology competency. It correlates with one of the most significant competencies of the individual, such as digital media literacy, as well as with practical, cognitive and emotional competencies that are used to acquire, analyse and create content of media in different circumstances (Vanwynsberghe, Verdegem, 2013).

3. Methodology

The empirical part of the research consists of several stages. Namely, the following nine general SCL principles were used as a basis to set criteria and measurable indicators characterizing the SCL approach (European Students' Union, 2015): 1) ongoing reflexive process; 2) not a one-size-fits-all solution; 3) different learning styles; 4) different students' needs and interests; 5) choice; 6) diverse experiences and knowledge; 7) student-controlled learning process; 8) enabling, not telling; 9) cooperation between students and staff. After the nine criteria with indicators were designed, the focus group discussion was organized to analyse the developed criteria and adapt the measurability of indicators to the context of the study process and university website. The seven-person focus group consisted of representatives of the Latvian Student Association, experts of pedagogy, experts in the field of education marketing and development. The method of qualitative content analysis has been used to acquire and process empirical data. Mixed selection, i.e. stratified and accidental methods, has been used to select data. Description of the section "On study programme" of RSU website has been studied taking into account the proposed criteria and their indicators. In total, eight descriptions of the Undergraduate study programmes have been researched: four Social Science and four Health Care programmes, three of them Academic and five Professional. Parts of the text and the message of narrative corresponding to each criterion and indicator have been selected and content of the selected text has been analysed.

3.1 The matrix of the SCL approach criteria and indicators

Orientation on the self-driven study process. High achievement motivation, active involvement of student, co-responsibility, and autonomy of student. 2) **Orientation on diversity in the study process.** The diversity of students' needs and interests, flexibility of the study content and organization, diversity of lecturers, social support, activities for individual's development. 3) **Systemic study process.** The content of study courses and programmes are developed on a regular basis; outcome evaluation and assessment methods; regular improvements in organization of studies; continuity of study courses, study year and study level and application of theory in practice. 4) **Implementation of partnership.** Regular and content-based feedback between student and lecturer, mutual cooperation between students, students' involvement in administrative activities. 5) **Choice of study content.** Possibility to choose themes, learning methods and type of assessment, interdisciplinary choice of elective courses. 6) **Effectively systemized study resources.** The diversity of didactic materials, study environment, and technologies used in the study process. 7) **Digitalization of the study process.** Use of digital media in the study process: access, analyses, evaluation and formation of media content, video lectures, webinars, transmission of lectures, communication on the e-study portal, digital correction of study papers and verification of the content authenticity (checking plagiarism). 8) **Competence of lecturers.** General and specific knowledge, skills, attitude, experience, personal approach in the study process, professional development. 9) **Study results and future perspectives.** Clearly defined study results, correspondence of the study results to the content and aim of the programme, mutual correlation between study programme and study courses, life-long education possibilities, and career opportunities.

4. Results

In the course of the survey, the following results have been acquired (they are enumerated according to the sequence of the set criteria):

Orientation on the self-driven study process. Seven of the eight descriptions of study programmes contain word "competitiveness" (in total 12 cases). Six descriptions display ambition to prepare highly esteemed professionals. The main keywords of the self-driven study process: comprehension, analytical and critical approach, knowledge synthesis, forecasting, active attitude, innovation, research, evidence-based decision making etc. In order to ensure primarily the co-responsibility of students and that they are engaged in the supervision of the ongoing processes in the society, they have to analyse, assess and clarify needs and priorities. High expectations are set in order to reflect the autonomy of students - students think both analytically and critically (10 times/cases), they identify problems (three cases) and predict processes and development (one case), consult (two cases) and

work independently in the chosen profession (three cases). The level of independence in the study process is reflected by individual work (six cases), research (four cases) and presentation of prepared projects (six cases).

Orientation on diversity in the study process. The descriptions of study programmes do not directly represent individual needs and interests of students. They are partly represented in the comments of the students and graduates published in the description of each programme. Two graduates emphasizes the topicality of knowledge and necessary competencies promoted by the University. The individual work, wide scope of themes, possibility to learn different languages (one case in each) are those which mainly reflect flexibility of the of study content. The level of flexibility in the study process organization is rather low as it mainly includes lectures (eight cases) and seminars, in two cases laboratory work. None of the mentioned/ of them represents the diversity of lecturers. One study programme indicates the possibility to work in the student radio.

Systemic study process. The learning methods used in various programmes are equal – lectures, seminars, laboratory work, individual work, abstracts, essays, and reports. In two cases, discussions and group work are mentioned as the learning method. In general, regular improvements in the study organization are not reflected. There is a general information regarding the application of theory into practice mentioning that practical lessons and praxis are realized (four cases). However, there are no descriptions on by what means they are accomplished and which are the possible opportunities for practical training. In addition, there is a lack of information on whether the University itself ensures a place for practice. Only once a definite practice opportunity is mentioned.

Implementation of the partnership. The feedback between student and lecturer is not displayed. Only once the student's practical work under the supervision of a lecturer is mentioned. In three study programmes, the video material is used to represent the cooperation of students. There is no reflection on students' involvement in the administrative processes.

Choice of the study content. Four out of the eight descriptions of study programmes contain information on the possibility to choose study courses, however, only in one case specific study courses are mentioned. Variety of possible learning methods consists of oral and written (two cases), independent work (six cases), abstracts, essays, reports (five cases), laboratory work (two cases) etc. Overall, there is a lack of information on the choice of the content.

Effectively systemized study resources. Didactic materials or information upon them are not reflected in the sections of study programmes. Description of the study environment expresses homogeneity and general information, such as in the auditorium, laboratory, medical institution and place of practice. In two cases the definite study environment is

given. The diversity of technologies is represented in four descriptions of study programmes, namely by mentioning the pharmaceutical technology, industrially produced medicine, computers, usage of the latest communication technologies, specifically the Internet and e-mail (one case in each).

Digitalization of the study process. Only two descriptions of study programmes contain information on digital media, such as theory and practice in new media (access, analyses and assessment), as well as information on the usage of computers, multimedia and the Internet in the study process. Three descriptions of study programmes contain video sections “Portrait of a Student” made by students of the Multimedia Communication programme. One description of the study programme contains a video featuring the head of the study programme addressing prospective students. All eight descriptions of study programmes contains various hyperlinks which lead to both internal and external resources of the website.

Competence of lecturers. Description of the study programmes does not contain information on lecturers’ competence. The study programmes’ description contains a hyperlink which leads to section of the Faculty’s website, where the centralized information on the professional experience of a lecturer is given.

Study results and future perspectives. The compliance between the study results and programme content is high. In five of the eight cases, there is a consistent sequence of tasks and results of the programme. The lifelong learning perspective is reflected by identifying particular Master’s Degree programmes, offering the possibility to continue further studies (seven cases). Seven study programmes’ descriptions cover information about the fields and professions students can work in after the graduation, as well as hyperlinks to the descriptions of the chosen professions.

5. Discussion and conclusions

This study found out that the descriptions of study programmes published on the RSU website provide incomplete information on the formulated criteria of the SCL approach. The data covered is ambiguous. Namely, there is a lack of some indicators, and both of the study programmes are demonstrated - those which successfully reflect the SCL approach and the ones requiring precision. The weak representation of digitalization of the study process confirms that in the course of developing the programme descriptions, the University’s staff does not identify clearly with the recipient, i.e. prospective student or a “digital citizen”, who has a need for the innovative learning space, as well as the connection and participation in the University and surrounding community (European Commission, 2013).

The most important characteristic indicating the implementation of the SCL approach that should be reflected both in the study process and on the University website is placing a student in the centre of the study process. Programme descriptions generally include high ambitions of the result, but it is important to note that in the SCL the process is central (European Students' Union, 2015). The expert of the pedagogy of the focus group emphasized that the main goal is the skills acquisition rather than the study programme acquisition and it should be taken into account for the SCL representation. Thus, it can be concluded that in the study programme descriptions there must be a balance between the information of the results achieved and the "road" to their achievement. There must be a possibility for a prospective student to find out information on the website about what and how he or she will learn.

Self-responsibility and ability to advance student's own knowledge is considered to be the base of the student-centred study process (Spooner, 2015; European Students' Union and Education International, 2011; Froyd, Simpson, 2010). The research results show that there are various ways of how to represent them, namely through learning methods, descriptions of study forms and students' practical engagement etc. Expert of the education development mentions that in order to promote the self-directed study process of a student, it is important that the student is aware of the common objectives and can personalize them. The representative of the Latvian Student Association stresses that the study descriptions must include course descriptions and defined learning outcomes. This will allow a student to feel if someone cares about whether he or she understands or not in which direction he or she is going.

As the research shows, implementation of the partnership is one of the most challenging criteria to be represented on the website, nevertheless, it is one of the main SCL aspects. In addition, information about the lecturers is not reflected in the descriptions, which leads to the conclusion that creators of the content are more focused on the objectives of the programme than on the individual. However, if the information about the lecturers is published on another website section, which is conveniently accessible, it is not a disadvantage. For this criteria, expert in the field of education development emphasizes that the University's staff must figure out what they want to say directly about the teachers, i.e. whether they have different teaching or communication styles etc.

Following the results of the study, several measures for the improvement of the study programme descriptions on the website to comply with the SCL can be set. The subject, namely as a student and a lecturer should not be underestimated. In addition, their roles and various opportunities for cooperation during the study period should be displayed. In order to develop a proper description of the study programme it is important to answer the following questions: "what will be learned?", "which career opportunities the students can have after graduating the programme?" etc. Nevertheless, it is also important to answer the

question on how the development of the individual will be promoted within the University. The variety of digital solutions cannot be too large. For instance, videos created by students can provide an excellent example of how the students' creativity, a possibility of choice and cooperation can be implemented in the study process. The capacity of the study programme is reflected in the presentation of the academic staff, therefore, it is recommended that each study programme description contains up-to-date and attractive portfolio of a lecturer.

The present study is an introduction of the SCL approach representation raising the topicality and promotion of the larger research in the broader context both nationally and internationally. The study shows the trends, but it does not allow to draw generalized conclusions on the SCL representation in the University and on the website in general. Therefore, the in-depth research should be continued, revealing the students' perspective. It would be necessary to carry out the survey among the current and potential students of the University to find out what aspects of the SCL they expect and how they perceive the information that the University offers on the website.

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Promoting Creativity and Innovation in Initial Teacher Technical Education in Ireland: A Case Study

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Abstract

The Galway-Mayo Institute of Technology (GMIT), Ireland, is a Higher Education (HE) provider of Initial Teacher Education (ITE). Graduates on its BSc (Hons) in Education (Design, Graphics and Construction) degree programme are qualified to teach technical subjects at second level. A defining element of delivery is the promotion of creativity and innovation in the classroom, by means of active, student-centred and design-led teaching and learning (T&L) strategies. This paper outlines a GMIT qualitative student-perspective pilot study, involving GMIT student teacher participants (n=42). The study aims to analyse the effectiveness of two selected platforms in the ITE programme: 1) presentation contributions by student teachers at the GMIT 'Creativity and Innovation in Teaching' Conference (2016) (n=14), and 2) a textual analysis of student online forum critical reflection submissions (2016-2017) (n=28). The research confirms the effectiveness of both strategies in promoting a practice of innovation and creativity in the classroom, including evidence of innovation, formative instructional practices and student-centred, active learning and design-led strategies in T&L. Challenges identified include classroom management and time management constraints.

Keywords: *Creativity, Innovation, Educational Technology, Technical Education, Initial Teacher Education, Active teaching Strategies.*

1. Introduction

The Galway-Mayo Institute of Technology (GMIT) is a Higher Education (HE) provider of Initial Teacher Education (ITE) in the technical field, in Ireland. Graduates on its *BSc (Hons) in Education (Design, Graphics and Construction)* degree programme are qualified to teach select technical subject areas at second level. A defining element of programme ethos and delivery is the promotion of creativity and innovation in the classroom. In February 2016, GMIT held a conference event, entitled, ‘Creativity and Innovation in the Classroom’, featuring best practice innovations by final year student teachers. In that same academic year student teachers also engaged in online forum critical reflections (using the Moodle platform) relating to their practice of teaching while on School Placement (SP). These two platforms were used to collate research data for this study. The research question addressed in this paper is: “to what extent do GMIT student teachers demonstrate creativity and innovation in their T&L strategies, in the technical classroom, while on School Placement?”. The two main research aims addressed in this paper include: 1) to identify/tabulate evidence of creative and innovative practices while on SP, and 2) to explore the student teacher experience of engagement with creative and innovative teaching practices, using selected examples from the data. Primary and secondary research methods are employed. Regarding the structure of the paper, a brief literature review is followed by accounts of the research methodology, findings, analysis, and conclusions.

2. Literature Review

The European Commission highlights the necessity to promote high quality T&L in European HEs (The European Commission 2013, p. 19). This expectation is reinforced by the Department of Education, the Higher Education Authority (HEA), the National Forum for Teaching and Learning, the Teaching Council (TC) and the National Council for Curriculum and Assessment (NCCA), Ireland. GMIT’s current Strategic Plan (2013) seeks to promote best practice and innovation in T&L. In the GMIT ITE programme, a culture of creativity and innovation, as well as active, student-centred and design-led T&L, is upheld, however, a challenge arising is the disjunction between a policy of student-centred active T&L in HE and a traditional, didactic approach, which is prevalent in many second level schools. This is a subject of discussion and debate in the Irish media in recent years (Flynn, 2012; Gleeson, 2013; Renville, 2015). In the 2007 publication *Active Learning and Teaching Methods for Key Stage 3*, the argument in favour of active teaching strategies is made that “young people need to have opportunities to develop personal capabilities and effective thinking skills as part of their well-rounded education (The Partnership Management Board, 2007, p. 1).

Approaches to creative, innovative and active student-centred learning promoted in the GMIT ITE programme include, among others: promoting problem solving strategies (Humphreys, 1996), facilitating student teachers to embrace change in the context of a rapidly evolving Teacher Education (TE) landscape (Quinn et al. 2014), training in Problem-based Learning (Barrett and Moore, 2011), explorations of and critical reflection on strategies for Design-led Learning (Owen-Jackson, 2015), engagement in a variety of Peer Observation, Teaching and Review processes (Klopper & Drew, 2015), and research-based teaching, learning and assessment (Cohen et al. 2000).

3. Research Methodology

This student-perspective study employed a qualitative research methodology. A total of forty-two student teachers were included in the study. Data collecting methods included: 1) the identification and tabulation of innovative practices employed by final year student teachers (n=14) while on SP, as recorded by the GMIT Creativity and Innovation in the Classroom Conference (2016) presentation slides, and 2) the identification of innovative or creative approaches by other students across the wider programme (n=28), identified within their SP online forum critical reflections (2016-2017). These two data sets are referred to as Data Set 1 and Data Set 2, respectively, in this study. Data Set 1 consisted of the conference presentation content, captured in the form of audio-visual recordings of the presentation and presentations slides content, and Data Set 2 was in the form of written forum reflection transcripts. These data sources were collated by the SP module leader (author of this paper). With respect to ethics, in particular research consent, in the case of Data Set 1, the conference event was live streamed, hence in the public forum, by prior agreement with all parties. In the case of Data Set 2 students were informed of the research via GMIT Learnonline and given an e mail 'opt out' option.

4. Research Findings, Analysis & Discussion

Research AIM 1 was to identify/tabulate evidence of innovative practices across the ITE programme. Using a method of manual coding of the data transcripts, illustrative examples were identified in student teacher practices, following repeated readings and re-readings of the transcript materials. Beginning with data set 1, the 'Creativity and Innovation in the Classroom Conference' presentation slides (2016) provided evidence of the use of a broad selection of creative, innovative, active, and design-led T&L practices on the part of the final year student-teacher presenters (n=14) while on SP. Evidence examples are tabulated below according to the dominant recurring categories of: 1) creativity and innovation T&L strategies, 2) active, student-centred T&L strategies, and 3) design-led T&L strategies.

Some student teachers (n=4) discussed a combined approach, incorporating more than one example of creativity and innovation, hence the number of examples provided in the cells in Table 1 (below) totals 18. Within the overall data, a balance of teaching examples across these three categories or themes were identified, demonstrating a comprehensive set of innovative and creative SP teaching tools and strategies.

Table 1. Data Set 1: Creativity and Innovation in the Classroom Conference 2016

Creativity & Innovation T&L Strategies	Active, Student -centred T&L Strategies	Design-Led T&L Strategies
<i>GRAFAIC</i> , a bilingual TG APP	Collaborative Learning (CL) Model Making	Collaborative Learning (CL) Table Top
<i>ConstrucTec</i> , a CS independent learning tool for Problem-based Learning (PBL)	Experiential Active Learning in CS.	Design-led Multimedia Pencil Holder
Traffic Lights Keyrings for formative assessment	Peer Presentations on Model projects in CS	Peer Poster Presentations
Augmented Reality tools in CS	Active Experimentation on timber moisture ratings & Student Laboratory Worksheets	Student Design Choice in Sketching & Graphic Design, in TG
‘Ticket Out the Door’ Exit Card Platform	Orthographic Projection Freehand Sketching Wall presentations in in TG.	Board Brainstorming using Mind maps
Incorporating Sign Language as a SEN Strategy	3 D Models in CS	Student Design Choice in Model Construction

Table 2. Data Set 2: Online SP Forum Reflections (2016-2017)

Creativity & Innovation T&L Strategies	Active, Student -centred T&L Strategies	Design-Led T&L Strategies
Sharing Learning Targets (BFK)	Each One Teach One	Design-led Projects
Traffic Lights & AfL (BFK)	Exit Cards	Back to Back
Student Experience Survey (BFK)	Self/Peer Assessment	Design-led Boat Building Project
Learning Ladders (BFK)	AfL Strategies	Design Mood Boards
HOPE strategies (BFK)	Collaborative Learning	Peer Board Drawings
FIP Strategies (BFK)	Think Pair Share	-
‘Sell Geometry’ TED TALK PBL Activity	Peer Demonstrations	-
ZPD Grouping	Socratic Method Discussions	-
Flipped Classroom	Class Debates	-
Circle explorations: deconstructing styrofoam spheres	Just a Minute	-
Consider All Factors	Poster Presentations	-
Jigsaw Game	WALT & WILF Strategies	-
Customised Student-friendly Technical Assessment Rubrics	Peer Presentations	-

AIM 2 was to explore the student teacher experience of engagement with innovative teaching practices. This discussion is framed under the headings: formative instructional practices (FIP) and hope strategies, creative assessment strategies, design-led T&L strategies, creative and innovative strategies in the use of educational technology, and challenges in the implementation of active student-centred T&L.

2.1. Formative Instructional Practices & Hope Strategies

Formative Instructional Practice (FIP) refers to T&L strategies promoted by *BattelleforKids* (BFK) (2016). These are comparable to Assessment for Learning (AfL) strategies promoted in the Irish context (NCCA, 2016). BFK strategies include: clear learning targets, documented evidence of learning, effective feedback, student ownership of their own learning, as well as ‘hope’ strategies. One practical example of a FIP strategy is the use of a ‘traffic lights’ system for homework collection and distribution, using red, orange and green coding or cards. One student teacher, who designed traffic lights key rings for students, writes: “I have employed this strategy when collecting assignments in my classes and I believe it to work very well as a non-verbal communication method”. Another student aligned BFK ‘hope’ strategies with John Bigg’s Constructive Alignment model, and developed learning targets and learning ladders to enable students to incrementally reach achievable goals and feel the hope of success in the classroom. The student writes: “(t)he class may complete the homework as many times as they like and seek advice for improvement. Thus far, this has improved students’ engagement and, more significantly, hope.”. Another student similarly links hope to setting out clear learning targets: “(b)y deconstructing and rewriting learning targets in more student friendly language I can help create a more student friendly classroom where students can relate to learning...developing hope”. A further hope strategy used by this student in the classroom was a ‘Ticket Out the Door’ exit card strategy, facilitating teacher feedback. Yet another student followed Rosenshine’s ‘Ten Research-based Principles of Instruction’ (Rosenshine, 2012) to proactively promote hope.

2.2. Creative Assessment Strategies

Creative examples of formative assessment strategies identified in the data include ‘exit cards’, ‘rubrics’ and student-engagement surveys. One student comments: “(e)xit cards allow me to look at the lesson through the eyes of my students”. Another student, quoting Walsh & Dolan (2009, p. 80) writes that “clear rubrics need to be developed that indicate the criteria for success in a particular learning activity. These are used to give the pupils explicit guidelines about teacher expectations”. Student surveys, in particular, were found to be effective. One student said: “I intend to use the information gained from student feedback surveys as a platform from which lessons can be developed”. Another student commented that “(t)he exit cards worked very well but the student experience survey

provided me with much more details on how the students felt in my classes”. Another student writes that he modified the lesson structure in response to student surveys, in week six of SP, to help optimize learning. Strategies to empower students to assess their own and others’ work are also discussed. One student writes that: “(t)he act of assessing an object and being able to say ‘I could make that!’ is a profound experience.”

2.3. Design-led T&L Strategies

Examples of learning by design, evidenced in the data, such as the multi-media pencil holder, the boat building project, design mood boards, and design-led projects, is “less about factual content and the mere acquisition of knowledge and more about enabling pupils to understand, think and do things (Robson, 2015, pp. 61-62). This approach has the potential to make the subject more engaging for students and provides for more individual expression. One student, citing Betty Ray (2004) - who correlates design-led T&L with 21st century skills, such as problem solving, collaboration, and real world solutions - writes:

The majority of my MTW projects have a major amount of design work to them. I feel like by doing more design practical projects it leads to more student engagement with the project as it is their individual work. On reflection I do feel that this style works quite well and I will definitely use it throughout my teaching career.

2.4. Creative and Innovative Strategies in the Use of Educational Technology

Particular examples in the data of creativity and innovation in the use of educational technology include: the development of GRAFAIC (a bilingual APP for technical drawing), the development of ConstrucTec (a flipped classroom independent learning tool for construction-related studies), an integrative education boat-building project combining technical subjects, and the invention of a system of whole-class peer teaching of demonstrations in SolidWorks and technical drawings, allowing the teacher to freely monitor learning in the classroom, described as follows:

My thought was to revolve the computer screen at the top of the room to allow students in the front row to use it but I felt the students behind would not be gaining as much as they would not be completing the [SolidWorks] demonstration. I then thought of using a tray with a wireless mouse and keyboard on it... [I am] quite excited to see how well these teaching strategies will work in a future lesson.

2.5. Challenges Arising

An array of active, student centred T&L strategies were identified in the data (See Tables 1&2) and the benefits are discussed above. However, certain challenges and problematics were also identified, including the implementation of innovative practices in traditional settings, where student teachers experienced cultural pressure from teaching staff to revert to more traditional approaches aligned with State examination expectations and demands. The requirement of effective classroom management skills was also identified as a prerequisite for more innovative approaches. One student reflected: “this week I tried to implement an activity called ‘Just a Minute’ where the students had to research a topic and present it to the class... it was difficult to keep the group on task and as a result the presentations were weak”. Another student wrote that when attempting a ‘Think Pair Share’ activity, it “went horribly wrong”. The student continues: “(a)ll I could do was question myself and, if I am honest, active teaching as a whole. Does it really work or is it something which looks great on paper but doesn’t actually work inside the classroom”? Apart from classroom management challenges, time management was identified as a further challenge:

...my attempts at creating an active student led classroom can definitely be improved. Last week I attempted to create a student led demonstration in technical graphics... The demonstration took so long that the students hadn’t enough time to finish the question themselves which really frustrated me.

5. Conclusions

This study examined the extent to which GMIT student teachers demonstrated creativity and innovation in their T&L strategies while on SP. The study found clear evidence of practices of creativity and innovation in SP as well as a critically reflective and probing implementation of student-centred, active learning and design-led T&L strategies in the SP classroom. The study identified T&L inventions, including key ring traffic lights, GRAFAIC (a technical drawing APP) and ConstructTec (an interactive PowerPoint tool to promote the flipped classroom in the field of construction studies). BFK FIP strategies were demonstrated, in particular, to have played a significant role in the promotion of effective creative T&L strategies in SP. Moreover, these strategies were considered instrumental in the promotion of hope in the classroom. The learning impact of such T&P activities and strategies and implications for reflective practice was the focus of some discussions; one student forum contribution sums this up effectively: “(d)esigning these activities gave me cause to reflect, if no learning takes place then these active learning activities are just activities”. Challenges were also identified, including: cultural differences between ITE training and the real world of the classroom, time management challenges, classroom management challenges, and a questioning of the overall value of creative classroom strategies, on the part of one individual who struggled to implement effectively.

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Leadership Academic Program Development in North America: Theoretical and Contextual Challenges

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Abstract

The development of a new academic field of study is always met with resistance and other challenges including the need to carve a space for the program in addition to defining and designing a curriculum that is unique and different from existing traditional academic programs. The research and dialogue about leadership academic education contribute to a rich debate about program design, content, curriculum and positioning. This paper explores the different levels of the theoretical debate about the best approaches to provide leadership education in colleges and universities in North America. Although the area of program curriculum design still lacks harmonization, areas of agreement have emerged over the years.

Keywords: *Leadership Education, Curriculum Design, Program Development.*

1. Introduction

The number of leadership education programs has increased substantially in North American colleges and universities over the past few decades. With this rapid increase, we are witnessing an important debate to identify a relevant space for this new field of study in an already crowded academic environment. Unlike many traditional disciplines, leadership educators are faced with a challenge of articulating a program model that will respond to the desire to teach leadership but to also help students develop their leadership potential. Within this context of growth, the need for research exploring the various strategies to develop and differentiate leadership education from other fields of study has never been greater.

The rapid development of leadership education is supported by an increased demand for leadership in all sectors. As suggested by Eich (2008, p. 176), “our nation (the US) is in a leadership crisis, one that requires more and better leadership in all areas of our society”. In Canada, the Conference Board (2008) suggested that we don’t need more MBA’s but more leaders. This trend will continue because of the high demand for leadership skills in our organizations. This growth has also forced leadership educators to not only reflect on the objectives and outcomes of their programs but to also explore how to position leadership education as a recognized new field of study.

This process has contributed over the past years in attempting to clarify and build the foundations for leadership academic programs. Research in this area also shows that there is a need to further reflect on harmonizing program design. This clarification of a foundation for such programs is essential because it helps students understand the types of skills, competences and expertise they will acquire throughout their educational journeys. It also helps employers to know the specific competences students graduating with a leadership degree may have and how they will contribute to their organizations.

2. Research purpose and context

Middlebrooks and Allen (2008) state that in any discipline, the success and recognition of the field must begin by addressing the following foundational questions of teaching and learning: “a. theoretical framework (what big picture assumptions and objectives inform the program?); b. curriculum (what content should we teach?); c. instruction (how should that content be taught?); d. influences (what influences our teaching and the student’s learning?); e. and assessment (how do we know if learning occurs?” (p. 78). While most of these questions are essential to the positioning of any program, those regarding the curriculum are central to any design.

As a founding member of the first undergraduate leadership program in Ontario (Canada), my colleagues and I have been very interested and involved in program development and designs over the past years, and have conducted several research projects related to how to develop and position our program within our institution. This experience led to several challenges related to institutional recognition, student recruitment, program design and identity.

In this paper an overview of the literature and debates regarding the development of leadership education in North America will be presented. An analysis and synthesis of the results of research my colleagues and I have completed over the past years to explore the emerging design models of leadership programs in North America will be highlighted.

3. Methodology

The methodology for this paper consists of reviewing the literature by presenting the major debates about the development of leadership education, and by summarizing the findings of three major research projects. A research project conducted in 2013 and 2016 using the Curricular Matrix model developed by Brungardt, Greenleaf, Brungardt and Arensdorf (2006) was used to study emerging curriculum design of leadership programs. This study by Brungardt et al. (2006) compared the leadership major programs from 15 universities in the United States through the examination of their academic curricula. They used a Curriculum Matrix in which all courses were classified under six different topic areas: Theory/History; Skills/Behaviors; Context; Issues; Internships, and Support. This model was used in two of our studies to identify similarities and differences between leadership programs.

In 2013, my colleagues and I conducted a qualitative research project to evaluate our own experiences of developing the first undergraduate leadership program in Ontario Canada. This study examines the ways in which competing discourses impact the sustainability of an undergraduate leadership program (McLaren, McGowan, Gerhardt, Diallo, and Saeed, 2013). Interviews and self-reflection were used to capture the context and the territorial conflict during program development. This also contributed to a reflection on the positioning of our program in the institution

In 2013, my colleague Dr. Gerhardt and I analyzed the curricular design of 26 undergraduate ‘Organizational Leadership’ programs using the framework developed by Brungardt to identify similarities and differences between programs (Gerhardt and Diallo, 2013). In 2016, we conducted another study analyzing the curricular design of 52 institutions offering a Minor in Leadership (13 institutions) or a Minor in Leadership Studies (30 institutions) in the United States using again the Brungardt et al. template to try

to identify if there is a core curricular emerging from leadership education programs (Diallo and Gerhardt, 2017). These two research projects surveyed the list of programs provided by the International Leadership Association (ILA) website. The data was collected from the program websites and using the list of required courses offered by each program. This research was motivated by our desire to adapt our own undergraduate leadership program created in 2004 to the emerging models.

This paper will provide a literature review of the different levels of debates and will also synthesize the core findings of our research in curriculum design and highlight several challenges that the field of leadership education still needs to address.

4. Overview of the Debate in the Development of Leadership Education

4.1. Growth of leadership education

The growth of leadership education is founded in the change of paradigm of our perception of leaders and leadership. While leaders may have innate qualities that may help enhance their leadership, it is clear that most of what leaders do can be learned and taught. Posner (2009) argues, “the notion that leadership is magical and reserved to a few inhibits the development of more leaders” (p.1). He adds that it is not the absence of leadership potential that inhibits the development of more leaders; it is the persistence of the myth that leadership can’t be taught.

The development of leadership education can also be linked to the growth of an important body of literature, research, theories and academic journals in the area of leadership (Riggio 2013). Some associate leadership education and liberal arts education (Wren, Riggio, & Genovese, 2009). Others promote the link between leadership education and business programs (Sowcik and Allen, 2013). Despite the desire of appropriation of leadership education by different academic programs, leadership education is carving its own space as a different and specific field of studies built from an interdisciplinary approach.

4.2. How to teach leadership

The question about how leadership should be taught has also been central to the development of leadership academic programs. A review of the literature on teaching methodology in leadership points to a plethora of ways to deliver information and develop student’s leadership skills (Bridgforth, 2005). According to Posner (2009), there is a problem with how many schools teach leadership. He argues that many inconsistencies regarding the focus, objectives, designs, and theories versus skills development has been noted by different researchers.

Seger (2013) suggests “that leadership skills are best learned by teaching through leadership, not about leadership, thus helping students to develop their leadership” (p. 253). Allio (2005) notes that programs tend to promote leadership literacy but not leadership competences. Posner (2009) believes that teaching leadership requires more than theories but doing, and he suggests using “action-learning” (or learning on the job). A study by Jenkins (2012) finds that “class discussion” –whether in form of true discussion or a hybrid of interactive lecture and discussion, and group and individual projects and presentations - are the signature pedagogy for undergraduate leadership education. It is also recognized throughout the literature that leadership education is constructed around experiential learning opportunities (Anselmi & Frankel, 2004).

4.3. Nature of leadership education

Today there is an agreement from leadership educators that leadership education is multidisciplinary. Sowcik (2012) defines leadership as “an interdisciplinary, academic, and applied field of study that focuses on the fluid process and components of the interaction between leaders and followers in a particular context” (p. 4). Leadership programs are designed by integrating several disciplines to create an approach to education that is unique. Middlebrooks and Allen (2009, p. x) note that “leadership scholars draw from anthropology, philosophy, psychology, sociology, communication, political science, business, education, public policy, and the growing fields of their own foundational work in leadership theory and research”.

The multidisciplinary nature of leadership education is also demonstrated by our research. Using the Curriculum Matrix developed by Brungardt and al. (2006), our own research results demonstrate how leadership programs include courses from several other disciplines including communication studies, organizational studies, experiential learning, and leadership-based courses.

4.4. Territorial conflict

Although the development of leadership education in universities and colleges continues to grow, where those leadership programs belong within the university is often an issue. Pennington (2005) notes that the evidence of the expansion of leadership coursework across courses and majors contributes to the emergence of some forms territorialism. In our own experience, our leadership program, which was designed as an undergraduate Honours BA in Leadership and offered since 2004 ended up being suspended because of a long territorial conflict with our business program. The compromise led to a redesign of the program from an Honours BA to a Minor in Leadership in 2013.

The core of the conflict was due to the belief by our business colleagues that many of our leadership courses were business courses. Many of our core leadership courses (Leadership Foundations, Organizational Leadership, Interpersonal Communication, Teams and Organizations) were considered to overlap with business courses. The incapacity to find a common ground of understanding led not only to suspending recruitment to the leadership program but forced our leadership team to redesign our program for a greater differentiation. Among problems we faced in this process, we can also highlight the difficulty of clarifying the boundaries of leadership education in a country where leadership education is in its infancy. We can also mention the limited administrative support during this process.

5. Summary of Research Results

5.1. Program curricular designs

The analysis of the curriculum was based on exploring commonalities and differences between leadership programs. Although there is an interest to develop common program benchmarks, many studies found very little consistency in curricular designs from program to program. The different studies from Brungardt and al. (2006), Gerhardt and Diallo (2013) and Diallo and Gerhardt (2017) share specific results. They all confirmed the interdisciplinary nature of leadership education with a multitude of design models. Results also show that there are many different names used by programs, from Organizational Leadership, Leadership, Leadership Studies to combined names (i.e. Leadership and Adult Education, or Global Leadership).

The research also found that programs are offered in both small and large institutions, and that programs are located in many different faculties and departments, from adult studies, professional programs to business schools. In this regard the different studies concluded that there is very little consistency in which department programs are housed. One of our studies reviewed 26 Organizational Leadership programs and found a multitude of home departments for leadership programs (Gerhardt and Diallo, 2013)

Table 1: Proportion of Leadership programs by Home Department/School

Home Department	Proportion	Home Department	Proportion
Business	0.277	Engineering/Tech	0.021
Leadership	0.213	Education	0.021
Professional Studies/Adult	0.138	Community Resources	0.011
Non-designated	0.128	Liberal Arts	0.011
Religious	0.064	Public & Environmental Sci.	0.011
Arts and Sciences	0.053	Agriculture & Natural Resources	0.011
Continuing Education	0.032	Psychology	0.011

Source: Gerhardt and Diallo (2013)

5.2. Curriculum content

Our two research studies in 2013 and 2017 confirmed findings from Brungardt and al. research (2006). All three studies found an important variety of design models. Although there were commonalities in course sequencing, the coverage of the different topic areas provided by Brungardt and al. was not consistent. Some topic areas are highly covered while others are less. This finding was consistent with all three studies. The study of Leadership minors we conducted in 2016 illustrates extreme cases where one can take a full minor in leadership without ever taking a course in communications (Diallo and Gerhardt, 2017). Results also show a stark difference of program focus. The studies found that the designs of the different programs were not impacted by the same scholars in the field.

Another important finding is that the differences in program names are not determining and doesn't mean a difference in program design. For example the study by Gerhardt and Diallo (2013) focused on 28 programs named Organizational Leadership and the results showed that there was a fairly even split between programs offered as a Bachelor of Arts or a Bachelor of Science. The study found no noticeable difference between the two groups.

The different research studies also highlighted interesting mixed results; although program designs were very different and didn't follow a clear pattern, some trends are starting to show. Most of the topic areas are covered with 'theories/history' and 'context' being the most covered topics. Courses under the 'theories/history' topic are the leadership specific content and courses under the 'context' topic provide an area of autonomy, differentiation between programs by specifying the types of organizational context (business, community,

not for profit, or public sector) or cultural, international or regional perspectives of programs learning objectives.

6. Conclusion

The purpose of this paper is not to call for a standardization of leadership programs curricular but to encourage the identification and recognition of a core that should be covered by all programs. The identity and recognition of the specificity of leadership education will gain by encouraging more harmonization of curriculum content and design. The field has reached a critical mass that should lead to a process of more consistency in program design.

With the multitude of leadership degree programs that exist, many studies have proposed or analyzed their curricular designs focusing on courses, their contents and their sequencing. In the quest to rationalize leadership curriculum, many approaches have been proposed. Recently, the National Leadership Education Research Agenda (NLERA) has encouraged new research direction for leadership education. The recommendations reiterate clarifying the content-based priorities of leadership education. While diversity in program design is inevitable because of the nature of leadership education, the identity of the field of study will depend on its capacity to better harmonize program designs.

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Implementing a Freshman Engineering Design Experience at the University of Washington

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Abstract

A project-oriented introductory engineering design course has been developed within the University of Washington's College of Engineering to enhance the first-year student experience. The role of engineering was demystified, explaining the difference between trade specialists and engineers. The students learned that the "art of engineering" is in solving complex problems. Throughout the course, students learned about programming, computer-aided design, and 3D printer technology to assist in the development of team projects. As each new prototype was unveiled, teams learned important lessons about the transition from conception to implementation. One of the biggest outcomes of the course was learning to work effectively in teams. At the end of the course, each team was assessed not only on quality of design project but also team efficacy. The students developed their professional socialization skills while preparing technical reports and oral (PowerPoint and poster) presentations. On the closing day of the program, students presented their group projects in front of campus and industry partners.

Keywords: *Introduction to engineering; project-based courses; first-year courses.*

1. Introduction

Engineering design courses have been identified as important pedagogical practices over the years to improve retention, student motivation and satisfaction, diversity, and student learning. Dalley and Zhang (1993) noted the design, build, test approach to be an effective pedagogical strategy to motivate students and develop their critical thinking skills. Dutson, et al. (1997) forecasted the increase in design courses in engineering curricula as a pathway toward better prepared graduates. Dym, et al. (2005) mentioned an improvement in professional socialization skills, noting the engineering design process as a social process, in which teams define and negotiate project design solutions. Borgford-Parnell, et al. (2010) discussed the effectiveness of project-based learning, highlighting how design project autonomy allows for authentic design experience and opportunities to reflect and learn from design processes. In an age of globalization, the National Academy of Engineering (Vest, 2005) has stated that future engineers must be trained to become experts in a variety of subjects and fields to solve complex global problems.

The University of Washington College of Engineering has developed a new engineering design course to provide an experiential learning experience to incoming freshman students. The course was intended to be rigorous, teaching design fundamentals that excite students about opportunities within the field of engineering. The design course was first piloted during an intensive Women in Science and Engineering (WiSE) summer bridge program. The instructor taught twenty incoming freshman about the engineering design process, programming, computer-aided design, and 3D printer technology. In a 4 ½ week course, students were able to design, build, and test design projects i.e. bridges, gears, rockets, and robots. Based on the outcome of the initial course, the program was scaled up to accommodate 100 students during a 10-week academic quarter.

2. Methodology

The newest version of the course had an instruction team consisting of a lecturer, three teaching assistants, and a laboratory shop manager. The goal was to provide students a broad perspective on engineering and help them decide on a career in engineering. There were two sections: a lecture component and a lab component. In the lecture section, the instructor taught students foundational mechanical and electrical principles. In the lab section, teams applied these principles to design, build, and test challenging projects centered on energy, environment, health, infrastructure, and exploration. The teaching assistants and laboratory shop manager provided additional content and development expertise throughout the quarter. The core components of the class were technical content and design, technical communication, and professional skills.

2.1. Lecture format

The lectures covered the engineering profession, professional standards and practices, the engineering design process, and laboratory shop skills. Throughout the quarter, rhetorical questions and “think, pair, share” pedagogical strategies were frequently used to engage the entire classroom. In addition, university and industry partners were invited to speak to the class about engineering design and its relevance in the public and private sectors. The UW Center for Engineering Learning & Teaching fostered a conversation on “how to work effectively in teams”, creating an environment to discuss teamwork and formulate an accountability plan.

A layout of the lectures taught are shown in Table 1. In the first week, an overview of engineering was presented. The second week discussed the importance of multidisciplinary teams, effective team communication, and engineering code of conduct and ethics. In the third week, the engineering design process was discussed. The simplest form is the 3-step: design, build, and test loop. For this course, an 11-step was chosen to provide students enough specifics while allowing for flexibility. The 11-step process is outlined in Table 2. In the fourth week, the importance of engineering drawings were discussed. Computer-aided design was introduced as an important tool engineers use to transform conceptual ideas, i.e. napkin sketches, into actual three-dimensional models. Students used either Autodesk Inventor or Solidworks as modelling software to design their projects. In the fifth week, students learned the difference between conventional manufacturing i.e. drill press, mill, lathe, band saw and additive manufacturing i.e., 3D printing. For design projects, 3D printing would be used to rapid prototype of parts for project assembly. General machine shop safety, rules, and regulations were also discussed. In the sixth week, fundamental engineering principles were covered broadly, relevant to design projects i.e. mass, momentum, energy, pressure, work, power, etc. In the seventh week, an introduction to electrical components, circuit design, and microcontroller operation were covered. The class spent time discussing how to program in Arduino’s open source software. In the eighth week, students learning programming in Python principles, relevant to control and analysis of design projects. In the ninth week, students learned engineering statistics and probability and how to collect and analysis data from projects. In the tenth week, class was setup as an open lecture, allowing teams to work on final design iterations and/or ask instruction team for final feedback prior to engineering symposium day.

Table 1: Lecture Sessions

Engineering Instruction
Week 1: Syllabus & Introduction to Engineering
Week 2: Engineering Design Challenges & Professional Skills
Week 3: Engineering Design Process & Communication
Week 4: Engineering Drawings, Computer-aided Design
Week 5: Safety, Prototype Construction
Week 6: Fundamental Principles
Week 7: Introduction to Electrical Circuits
Week 8: Introduction to Programming
Week 9: Engineering Analysis
Week 10: Open Lecture - Engineering Design Final Iterations

Table 2: 11-step Engineering Design Process

(1) Understand – define the problem
(2) Explore – do background research
(3) Define – determine solution specifications
(4) Ideate – generate conceptual solutions
(5) Prototype – learn how concepts work
(6) Choose – determine a final concept using a weighted objectives table
(7) Refine – do detailed design
(8) Present – get feedback and final approval
(9) Implement – build the detailed solution
(10) Test – does the solution work?
(11) Iterate – repeat the cycle if desired outcome not obtained

2.2. Laboratory Format

A breakdown of the week-to-week labs are shown in Table 3. The labs occurred in a new laboratory facility located in a student dormitory. The laboratory facility was a mini-machine shop with 3D printers, laser cutters, soldering stations, and cutting and drilling equipment. In the first few weeks of the quarter, three impromptu design challenges were introduced to build team camaraderie and enhance active learning. These challenges included a slow descending aerial vehicle, a tallest tower, and a catapult. After team-bonding exercises, teams finalized their design projects, selecting from a list of twenty distinct design challenges. The types of selected design projects are shown in Figure 1. Each team was given access to similar resources, i.e. access to modelling software, machining tools, nuts and bolts, electrical components, Arduino kits, and Flash Forge Creator Pro 3D printers. For each design challenge, each team had to satisfy design constraints and meet functional requirements. All design teams were constrained by a pre-allocated budget and limited time. A list of the specifications for some of the design challenges is presented below.

- **Prosthetic Hand/Arm Design Challenge:** A team of engineers has been tasked to build an Arduino-controlled prosthetic hand/arm. The prototype must be a functional realistic design, with the ability to move freely or grip an object.
- **Unmanned Aerial Vehicle Design Challenge:** A team of engineers has been tasked to build the most efficient Arduino-controlled unmanned aerial vehicle. The prototype must be functional, with the ability to move vertically upward. The team had to predict the maximum height and time of flight for their specific designs.
- **Robot Design Challenge:** A team of engineers has been tasked to build the most efficient, creative Arduino-controlled robot system. The prototype must be able to move freely in at least one direction. The team had to predict how far and fast their vehicle would travel.
- **Submersible Vehicle Design Challenge:** A team of engineers has been tasked to build the most efficient, aesthetically pleasing Arduino-controlled submersible vehicle. The prototype must be waterproof with the ability to move freely in one direction, above or below water, without sinking below a desired depth.

Table 3: Laboratory Sessions

Engineering Laboratory
Week 1: Pick Design Teams
Week 2: Impromptu Design Challenges
Week 3: Engineering Design Process (EDP) Development
Week 4: Team CAD Work
Week 5: Team CAD Work & EDP Presentations
Week 6: Prototype Development
Week 7: Prototype Development
Week 8: Programming using Python/Arduino IDE software
Week 9: Programming & Engineering Analysis
Week 10: Final Design Iterations & Mock Presentations
Finals Week: Engineering Symposium Day

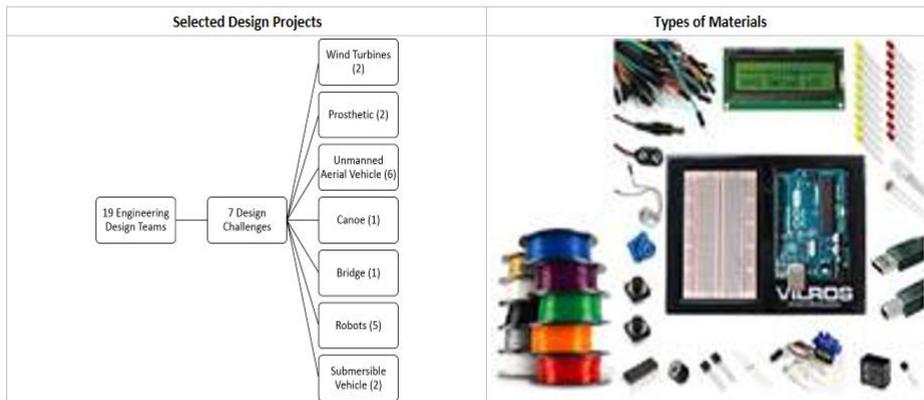


Figure 1: Selected Projects and List of Materials

2.3. Course Assessment

Based on the work by Moore (1994) in an introductory electrical engineering design course, a holistic grading scheme was used to evaluate student and team performance. Students were evaluated based on completion of reflection exercises and team-oriented activities. Reflection exercises represented 20% of overall student score. Team-oriented activities toward the development of design projects represented 80% of overall student score. A list of course assignments is shown below.

- **Engineering Assessments:** Bi-weekly reflection exercises were used to enhance student comprehension and transformation of lecture and laboratory content.
- **Team Contracts:** Teams developed an agreement amongst team members that outlines roles and priorities toward project design success. Each member pledged to distribute work evenly and build consensus in the event of conflicts.
- **Engineering Design Process Presentations:** Teams developed Powerpoint presentations, providing a status update to the instruction team. These presentations were used as mid-quarter preliminary design review sessions, providing constructive feedback.
- **Team Progress Reports:** A two page document that outlines the team's design challenge, background research, and methodology.
- **Mock Presentations:** Final design review sessions, providing last minute feedback prior to teams presenting prototype in front of the college and industry partners.
- **Engineering Binders:** Teams were required to document the product development process from conception to implementation. Each team needed to include their team contracts, engineering design process, progress reports, final reports, and assessments.
- **Design Posters:** Teams presented a poster at the engineering symposium day, displaying the engineering design process and final product development.

2.4. Individual Scores

As mentioned earlier, the instruction team decided to assign 20% of overall student score based on the completion of four reflection exercises. The remaining 80% of overall student score was allocated based on student participation within team-oriented activities. Student participation acted as a multiplier of overall team score. 100% student involvement in team activities yielded full team score. Student participation was assessed using both visual diagnostic, i.e. instruction team observing student involvement in labs, and anonymous peer evaluation forms submitted online to instruction team. There were two peer evaluation forms, one mid-quarter and the second at the end of the quarter, to assess individual student contribution to team product design. The two peer evaluation forms were averaged to determine a variance for grade allocation.

3. Results and Discussion

3.1. Final Product Development

The design teams presented their projects during finals week at an engineering symposium day to showcase their cornerstone projects to the UW College of Engineering community and affiliated partners. Some of the design teams are highlighted in Figure 2. There were three components being judged at the showcase: (1) design products, (2) engineering binders, and (3) team posters. The team with highest marks in all three categories received the top design award, receiving recognition from their peers and the UW College of Engineering community. Moreover, all teams received positive, constructive feedback from instruction team and showcase attendees.

3.2. Student Responses

At the end of the course, students provided an evaluation of their overall feelings about the course. A sample of selected responses have been included below.

- “I’m particularly happy with the fact that my project had a controls aspect and that I had a chance to learn to interact with Arduino. This design project fits well with my major which is electrical engineering.”
- “I enjoyed the design project. It was quite fun to go through the trial and error to find the design that best solved our UAV challenge. My major choice is mechanical engineering, so I plan to work on project team interested in building a waterproof submarine made of PLA.”
- “I thought our race car project was fun and overly successful. Going forward, I’m interested in creating an app for android that could be used to control the car over wifi. This will be within mechanical engineering.”
- “Overall, I am very happy with our design project. Our goals were to build a prosthetic arm with the time and budget we were given and I am happy to say we have satisfied both those goals! I will apply what I learned during this design project toward my next project team, EcoCAR.”

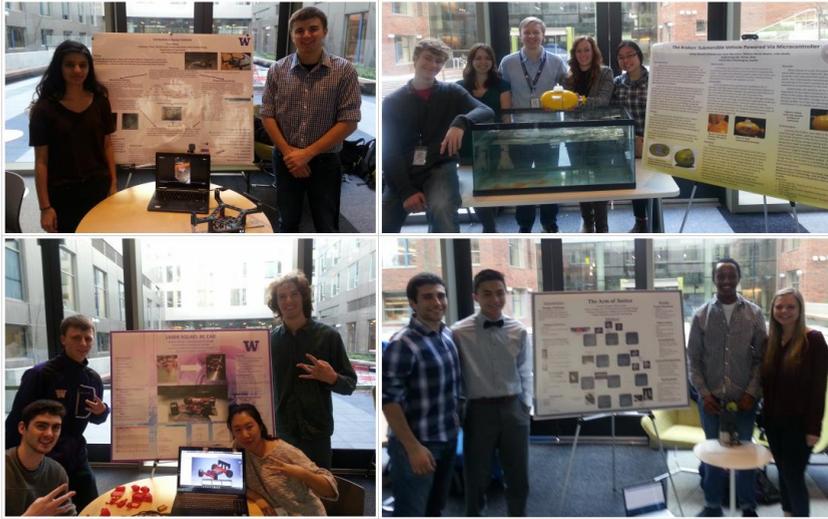


Figure 2: Top Left – Unmanned Aerial Vehicle, Top Right – Submersible Vehicle, Bottom Left – Robotic Vehicle, Bottom Right – Prosthetic Arm.

3.3. Discussion

The instruction team saw student growth in the areas of modelling, 3D printing, coding, and product development. A diverse team of students, from various scientific and cultural backgrounds, learned to work effectively to create elegant project design solutions. Overall, the course was successful in providing first year experiential learning, allowing students to transfer newfound knowledge to future classes and project design teams. The course can be improved by accommodating more open-ended design projects that fit within the UW College of Engineering themes.

4. Conclusion

A new introductory engineering design course was developed at the University of Washington to provide hands-on experience to freshman students. The 10-week course challenged students to be creative and collaborative with their teams to develop a functional product. Students mentioned an increase in engagement in pre-requisite and engineering fundamental courses while taking the design course concurrently. Going forward, a \$30 student user fee will be included in future offerings of the course to cover the entire cost of laboratory supplies, equipment, and maintenance. The course will include more Arduino-actuated design projects, with project team guidance from upper division undergraduates. The upper division undergraduates will receive academic leadership credits, serving as emerging scholars who mentor and oversee project development of freshman design teams.

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Teaching Agile Development with DevOps in a Software Engineering and Database Technologies Practicum

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Abstract

DevOps is a new concept for Software Engineering. Teaching DevOps can be challenging with the limited resources that are available at many universities. This paper exams how to teach of an Agile Development Methodology using a DevOps approach for the Regis University (RU) M.S. in Software Engineering and Database Technologies Practicum. With faculty support, heavy stakeholder involvement and RU Information Technology Services department (Operations Support) mentoring, students were able to successfully follow the Agile Development methodology to create an application that was incorporated into the RU Web-site infrastructure.

Keywords: *Teaching DevOps, Agile Development*

1. Introduction

DevOps is a new term for the subject of Software Engineering that combines the areas of Software Engineering (a.k.a. Software Development) and Operations Support into one methodology. Traditionally, the development of software by Software Engineering organizations has followed the Systems Development Life Cycle (SDLC). This is a methodology that has been used by project management for the last 40 years to manage software development projects. The SDLC usually includes a feasibility study (planning), analysis, design, coding, testing and then deployment of the application to the production environment. After deployment, the maintenance of the new application is often handed off to the technical support personnel in the Operations Support organization. Unfortunately, if the new software has defects, then Operations Support is tasked with resolving the defects (e.g. fixing the errors or finding work arounds). Over the years, this separation of concerns has created barriers and tension between Software Engineering and Operations Support.

Jabbari, Ali, Peterson and Tanveer (p. 18, 2016) completed a systematic mapping study of 44 papers from six electronic databases (e.g. ACM, IEEE, Inspec, etc.) on the topic of DevOps and then synthesized the following definition:

“DevOps is a development methodology aimed at bridging the gap between Development (Dev) and Operations, emphasizing communication and collaboration, continuous integration, quality assurance and delivery with automated deployment utilizing a set of development practices.”

Fitzgerald and Stol (2014) recognized that DevOps is the integration between software engineering and operational deployment and that it should occur on a continuous basis.

The term Continuous Software Engineering includes the entire software life-cycle sub-phases of Business Strategy & Planning, Development and Operations. Continuous processes can include deployment, planning, integration, testing, and run-time monitoring.

Continuous deployment can be a radical shift in comparison to the conventional waterfall release cycle that can take months to deploy new software into a production environment. Spencer (2014) proposed an example of an agile release cycle that involves:

- Small code changes are made, tested & deployed on a daily basis
- Functional requirements are updated every other day
- Operations Support testing occurs 1 – 2 times per week
- Hardware installation done as needed
- Early Life Support (ELS) and Continual Service Improvement (CSI) is done on a daily basis

Humble and Molesky (2011) characterized the principles of Continuous Software Engineering and DevOps as a shared responsibility for collaboration between Development and Operations Support that uses automation and measurement to improve software quality.

The DevOps handbook elaborates on the three ways for implementing DevOps that are listed below. (Kim, Humble, Debois, Allspaw, & Willis, J., 2016). The three ways were initially presented in an IT novel by Kim, Behr, & Spafford (2014). The 1st DevOps principle is the implementation of an accelerated delivery flow from Development to Operations Support to Production (Customers) and includes:

- Controlling the queue size of Work in Progress (WIP) to be very small.
- Small batch sizes of work – less WIP, faster lead times, error detection and less rework.
- Test environments that built in advance and continually updated.
- Loosely coupled architectures, such as Service Oriented Architecture.
- The 2nd Principle is feedback that enables the creation of ever safer systems of work and includes:
 - Defects or significant deviations are quickly found and acted upon by the team.
 - Feedback loops are created at all levels, Project Management, Development, QA, Info. Security and Operations Support.
 - A swarm approach by all team members is taken to solve problems with whoever needs to be involved. This involves learning and immediate resolution to the problem.
- The 3rd Principle is Continual Learning and Experimentation and includes:
 - Changing the culture of the organization to value organizational learning and institutionalize the concept of improving daily work
 - Change the culture to accept the fact that failures will always occur in complex systems
 - Encourage an open dialogue about problems across departments
 - Local learning should be shared globally

2. Teaching DevOps and Agile Development

Christensen (2016) outlined his challenges for teaching DevOps and proposed teaching techniques focused on DevOps. Teaching DevOps can be challenging because of the following reasons:

- Limited Operations Support experience of the faculty teaching DevOps
- Most university courses are focused on development or operations, but not both topics
- DevOps is focused on hands-on skill competency, such as coding, database configuration, etc.
- Creating a realistic production environment for testing applications can be a daunting task because of financial constraints at many universities
- Evaluating student work can be difficult without actual testing in a production environment, especially performance tuning for high volume transactions

Based on these challenges, Christensen (2016) developed a Cognitive Apprenticeship and Story-Telling Approach for teaching DevOps within a Cloud Computing course that is taught at Aarhus University in Denmark.

- Students designed and coded a simple distributed system called “SkyCave”
- Student deliverables included the documentation and code for the application
- Grades were based on the amount and quality of the work submitted
- No specific deadlines were enforced except for the final end of course deadline
- Feedback for the class exercises was completed with 24 hours of the student submission

Sjodin and Barnes (2016) hosted a panel discussion at the 25th Annual CCSC Rocky Mountain Conference Program at RU in Denver, Colorado. They discussed an Agile Development Methodology in Computer Science courses offered by CC&IS. This type of rapid software development is in alignment with what Spencer (2014) was suggesting. The panel proposed teaching methodologies for both online and classroom courses that included fully automated real time validation, continuous testing and deployment. Highlights from the panel discussion on the Agile Development Methodology are as follows:

- Project Charter – should consist of a one paragraph executive summary, identification of stakeholders, use case diagrams based on business requirements
- Initial Planning – Use Cases are prioritized, a tentative schedule is developed, and the product backlog is reviewed
- Iterations – Elaboration of specific Use Cases (descriptions, write ups, fully-dressed)
- Design - UI: Site Map, Wire Frame Mockups, Class Diagrams, Sequence Diagrams
- Configuration Management using Git, such as the Gitlab or Github tools
- Iterative Development (1 – 2 weeks) with Unit & Functional Testing
- Standups (i.e., providing status with the 3 Ps: progress, problems, plans)
- Incremental, Continuous Deployment as suggested by Fitzgerald and Stol (2014)

3. RU CC&IS Software Engineering and Database Practicum

The RU College of Computer and Information Sciences (CC&IS) Software Engineering & Database Practicum is comprised of two courses that satisfy an exit strategy requirement for the Master of Science in Software Engineering and Database Technologies (MS SEDT) program. A total of 36 credit hours (12 courses) are required to graduate from the program. After completing many of the software engineering and database courses, students participate in the SEDT Practicum for one semester (two concurrent eight week terms - Practicum I and II).

The SEDT Practicum II course facilitates a real-life, hands-on learning experience via the development of operational software. Students participate on teams of 4 – 6 students and follow an Agile Development Methodology as outlined by Sjodin and Barnes (2016). The SEDT Practicum Project allows students to demonstrate Software Engineering and Database Design skills that been acquired in earlier course work.

The SEDT Practicum I course provides additional training in the form of lab exercises on the topics of Microsoft SQL Server, MS Visual Studio using C++, MVC 5 Scaffolding, Linux and Oracle Enterprise Manager. In addition to technology training, students participate in an Operations Support environment working as Database Administrators. Students create and manage all of the databases that are used in the undergraduate and graduate courses within the RU CC&IS. Students staff a help desk and resolve a variety of operation support issues for the databases within the Linux OS and Windows OS environments. Tasks include space management, creating user IDs, granting access privileges, installing vendor software and performance tuning the databases.

3.1. RU Scholar Database Project

In the Fall 2016, the administrator for the RU Center for Scholarship and Research Engagement (CSRE) approached the lead faculty for the SEDT Practicum. He asked if the practicum students could participate in the development of a web-based database application to assist with the management of Research materials for the five colleges within RU. Normally, this project would be developed by the RU Information Technology Support (ITS) Operations Support team, however ITS was unable to work on the project for at least a year based on a huge backlog of other projects with higher priorities.

The Regis Scholar Database Project was selected for the practicum because the initial release size was small and would support the Agile Development Methodology described by Sjodin and Barnes (2016). For example, the initial project release involved the design and creation of eight relational database tables and their supporting web-pages. The primary function of the application is to allow prospective students, media, faculty scholars and others to quickly and easily link scholars with related research interests. The home application webpage (shown in Figure 1) was added as a link from the main RU Library Digital Commons webpage because it is a location that faculty and students use to find Research materials. Therefore, it made sense to co-locate this new web-application with other commonly used Research links, such as the online Research Databases (e.g. ACM, IEEE) and links to other library support services.

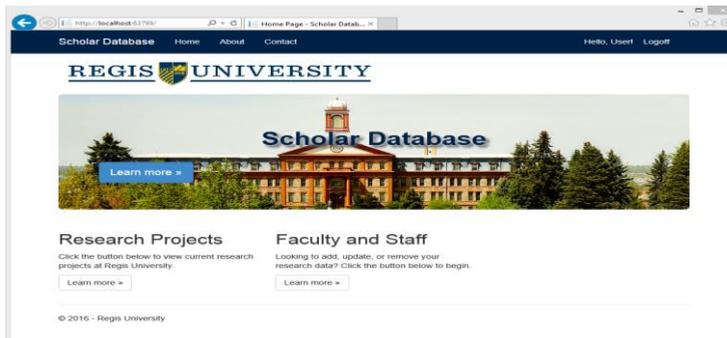


Figure 1. The home page of the RU Scholar Database application (2016).

4. Results of using the Agile Development Methodology with DevOps

The following chronology of events documents the results of using the Agile Development Methodology with a DevOps Approach within the MS SEDT Practicum. Students and Faculty met at online Skype meetings 2 – 3 times per week to discuss and review the project deliverables. Students within the program are located throughout the USA, therefore online meetings are the only feasible way to meet as a group synchronously.

Project Charter and High-Level Documentation – Students developed a Project Charter that consisted of a paragraph for an executive summary, identified the stakeholders (RU CSRE staff, Faculty, external entities, etc.), documented the Business Requirements and then created the Use Case diagrams based on the Business Requirements. These deliverables were reviewed for approval by the Faculty Lead and then the RU CSRE staff.

Initial Planning – The Use Cases were prioritized by Faculty Lead and the students. Some Use Cases were deferred to future product releases which made the scope of the project very small. Subsequent approval of the release size was obtained from RU CSRE staff via an online meeting. Because the project was using an Agile Development approach, one Use Case was selected for initial development. The Use Case was elaborated upon with descriptions, write ups and basic logic to meet the criteria for a Fully-Dressed Use Case and reviewed by the lead faculty. A very basic ERD was created for the first Use Case and a few Wire-Frames (Web-page designs), Class Diagrams and Sequence Diagrams were also created within a few days.

Initial RU ITS (DevOps) Touch Point - Prior to beginning coding of the first use case, the Faculty Lead met with the RU ITS Operations Support team to collaborate on the development platform and development coding standards. Since RU ITS would later support the software in production, they provided suggestions for the development platform, ideas for testing the code in the Integrated Development Environment (IDE) and they shared their development process and coding standards. ITS agreed to conduct code review and thus provide mentoring for the students on Best Practices. The development platform was as follows:

- Microsoft (MS) Visual Studio (VS) Community Edition 2015 with C++ using MVC and Scaffolding. ASP .net is not used by Regis ITS. The VS Community Edition 2015 is free for download and provides a good IDE for coding and unit testing. VS also has a local database that simulates a connection to MS SQL Server.
- Microsoft SQL Server was used as the Relational Database Management System because it is the standard database used by RU ITS in production.
- Gitlab was selected for Configuration Management. Gitlab was chosen instead of GitHub because it allowed the projects to be concealed (hidden) from the public

and the web application is free to use. This product was recommended by RU ITS because they use a local Gitlab repository to house all of their development work. Thus, it was easy for ITS to review the code as it was being developed and checked into the repository and then incorporate the deliverables into their local Gitlab permanent repository. Also, Gitlab allows for separate development tracks for each student that can later be merged with the main development track after unit testing.

- Unit Testing was accomplished using local Windows machines owned by students and by Windows Virtual Machines (VM) on the RU Network that the Faculty Lead created for the students. A VM Windows Server 2012 was created and SQL Server was installed in that machine.

DevOps review of initial code – After students developed and tested the initial code for the first Use Case, RU ITS was asked to review the code to provide feedback. This enabled the students to get immediate feedback and thus incorporate the lessons learned into the code for the remaining Use Cases.

Begin Small Development Iterations - The remaining Use Cases (within the project scope) were elaborated upon with descriptions, write ups and basic logic to meet the criteria for a Fully-Dressed Use Case. Completed Use Cases were reviewed with the Faculty Lead and then the RU CSRE staff. Initial review by the Faculty Lead allowed the students to make minor corrections to the Use Cases prior to the RU CSRE review.

Remaining Design of other Components – The design stage leveraged the remaining Use Cases to develop a complete Entity Relationship Diagram (ERD) in third normal form. This diagram was reviewed by the students and the Faculty Lead several times. Initial drafts of the ERD were sent to the Faculty Lead via email and then the final draft ERD was reviewed during an online meeting. Eight relational tables (six new tables) were then created with DDL from the ERD. After ERD approval, students created Wire Frame Mockups (Web-Page Designs), Class Diagrams and Sequence Diagrams for the remaining Use Cases. The Wire Frames Mockups were reviewed with the Faculty Lead and then the RU CSRE staff for approval. The students presented the Wire Frame Mockups at a University-Wide Faculty Presentation by the RU CSRE staff in regards to the new application. The Class Diagrams and Sequence Diagrams were reviewed during the online meetings with the Lead Faculty. All of the design documents were added to the Gitlab project and shared with the development team so that team members could learn by reviewing other students work.

DevOps review of remaining code - As mentioned previously, RU ITS agreed to mentor the students by performing code reviews of the code for the remaining Use Cases. Verbal and written feedback was given to the students regarding adherence to the RU ITS development standards and best practices.

Code Adjustments – were made to the application software based upon the code review feedback in preparation for the final delivery/turn-over of the software to RU ITS. A final overall code review was conducted with RU ITS prior to accepting the code for production. RU ITS made minor enhancements to the code by adding LADP access code for user authentication which they wanted to keep internal (secure) to their department.

Incremental, Continuous Deployment – Enhancements to this application will follow the same Agile Development methodology that uses a DevOps approach. Small incremental improvements will be made to the software and then will be tested in the VM Cloud environment.

5. Conclusion

The Scholar application developed by the MS SEDT students was well received by RU ITS Department (Operations Support). The ease of acceptance resulted from a) adhering to the mentoring from the RU ITS Department, b) following the development standards and c) the use of the RU ITS development platform (e.g. Visual Studio C++, MS SQL Server and Gitlab). The code review provided by the RU ITS experts to the practicum students was immensely beneficial because it provided a real-life learning experience (feedback from experts) to the students. The use of the Agile Development Methodology using a DevOps approach was a successful endeavor because it included the direct involvement of the RU ITS (Operations Support), mentoring by the faculty and heavy stakeholder (RU CSRE staff) participation throughout the project.

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University Educators' Instructional Choices and Their Learning Styles within a Lesson Framework

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Abstract

Research on learning styles often focuses on the learning style of the student; however, the learning style of the educator may affect instructional choices and hinder learning. Few studies have addressed the lack of knowledge that exists in universities with respect to educators' learning styles and a lesson framework (development, delivery, and debriefing). This sequential mixed methods study explored university educators' conscious, reflective instructional choices as they related to learning styles application within a lesson. Two theoretical and one conceptual frameworks drew on Kolb's experiential learning theory, Bloom's, Reigeluth's, and Gagné's instructional design theories and models, and Fiddler's and Marienau's events model of learning from experience. Research questions addressed learning styles, usage patterns, instructional choices, and reflections of university educators within a lesson framework. An online inventory recorded 38 university educators' instructional choices, learning styles, and learning styles patterns within the framework of a lesson. Interviews were conducted with 7 of the university educators to document their conscious reflections regarding their instructional choices. Results from the inventory identified that more than 56% of university educators applied the accommodation learning style during the stages of development and delivery of a lesson, and 34% applied the assimilation learning style during the debriefing stage, which were supported by detailed reflections about their instructional choices in relation to their learning styles. The knowledge acquired about learning styles applications during a lesson framework may benefit university educators' teaching, which are foundational to affecting positive social change within academic and social communities.

Keywords: *instructional choices, learning styles, lesson framework.*

1. Introduction

University educators are critical contributors to the development of programs, courses, and lessons. As part of their role, educators are expected to create comprehensive, learner-centered lessons that provide students with key information about topics. There are various factors that influence how educators develop their lesson plans, including context, content, intent, and arrangement of materials (Stark, 2000, p. 413). Additionally, teaching strategies (Gagné, 1987; Bloom, 1956; Grasha, 2002), learning style preferences (Kolb, 1984; Rayner & Riding, 1997), experiences, events and meaning (Fiddler & Marienau, 2008), as well as instructional choices, elaborations, and reflections (Kolb, 1984; Reigeluth, 1978) influence educators' decisions about a lesson, and also influence a lesson's learning outcomes in relation to educators' learning styles. Similar to other learners, the learning style preferences of an educator develops early in life and continues to evolve, merge, intermix, and scaffold layers of knowledge, experience, and humanness into a complexly patterned and collaboratively comprehensive system that is used to sustain an educator's advancement of learning and teaching processes.

As such, given that a learner developed his or her learning style preferences prior to becoming a university educator, and given that both learning and teaching style preferences derived from the same individual who moved from one role to the other (learner to educator), it is with alacrity that the university educator's learning style preferences influence the decisions he or she makes when determining reflective instructional choices such as course and lesson content, assignment and assessment activities, delivery and presentation media, and debriefing and reflective approaches to lesson creation. These choices employ the processes of reflection through contemplation, through reflective skills learning, through experimentation (Jarvis et al., 1998, pp. 54-55), as well as through the generation of reflections in the form of ideas and theories both from educators and others (Fiddler & Marienau, 2008, p. 82). There exists a gap in knowledge about the relationship between university educators' application of their learning style preferences and the reflective instructional decisions they make within the framework of a lesson (development, delivery, and debriefing). Hence, this study examined the relationship between conscious reflective instructional choices and learning styles within the framework of a lesson.

1.1 Theoretical Foundation

Two theoretical foundations and one conceptual framework were used in this study: 1) Kolb's (1984) experiential learning theory (ELT) informed learning style application, 2) Bloom's (1956), Reigeluth's (1978), and Gagné's (1987) instructional design theories and models as they supported instructional processes, and 3) Fiddler's and Marienau's (2008) Events Model of Learning from Experience.

2. Purpose of the Study

The purposes of this mixed methods sequential explanatory study were two-fold. The first purpose sought to identify the conscious reflective instructional choices of university educators' within the framework of a lesson (development, delivery, and debriefing), to identify the learning style preferences of university educators as they were applied within this framework, and to determine the learning styles usage pattern based on a coding system resulting from these applied learning style preferences (quantitative).

The second purpose of this study aimed to explain the meaning of university educators' conscious reflective instructional choices using in-depth interviews to capture the reflections, attitudes, and rationales attached to these choices. While the outcomes of the EICLS Inventory (Mazo, 2008) included the identification of university educators' instructional choices within a lesson framework, it did not provide an explanation as to *how* and *why* they arrived at their instructional choices. The inclusion of qualitative data gathered in the form of interviews provided a triangulation of the results. In-depth information captured through reflections, attitudes, and rationales provided explanations for university educators' instructional choices.

3. Research Questions

The following two main questions were developed to guide the methodology, design, and structure of the study: 1) How are the conscious reflective instructional choices that university educators make within the framework of a lesson (development, delivery, and debriefing) affected by their learning styles?; and 2) When university educators make instructional choices within the framework of a lesson (development, delivery, and debriefing), what conscious reflections about these choices do they make?

4. Methodology

The population for this mixed methods sequential explanatory study consisted of a broad spectrum of university educators within the United States and Canada and derived from: the following two groups: 1) Walden University Participant Pool, and 2) United States and Canadian universities via the International Centre for Educators' Styles (ICES) website. Participant characteristics included university educators who taught in various disciplines, whose teaching experiences varied in length of time, who were representative of both male and female genders, who derived from the United States and Canada, and who represented different age groups.

The study was initiated with a quantitative data collection process through the administration of the EICLS Inventory (Mazo, 2008). Educators then consented to participate in an in-depth interview session where they were able to articulate their reflections in relation to the conscious reflective instructional choices they made when

completing the inventory. The responses that were recorded in the inventory were used to structure the in-depth interviews. Data were analyzed through research statistical software applications.

5. Results

An examination of quantitative and qualitative findings revealed two key associations between the EICLS Inventory (Mazo, 2008) responses and the interview transcripts. These two core associations indicated a solid triangulation of the data that supported the nature and focus of this research study.

Regarding the first purpose, conscious instructional choices of educators during a lesson framework (development, delivery, and debriefing), the results from the inventory identified that more than 56% of university educators applied their dominant learning style of *accommodation* during the stages of development and delivery of a lesson. This indicated a consistent application of *accommodation* as their dominant learning style. As well, results from the inventory indicated that 34% of university educators applied the *assimilation* learning style during the debriefing stage of a lesson, demonstrating a shift in dominant learning style application. The overall resultant dominant *learning style usage pattern* was #34 (of 61 possible patterns), which included the following coding system: EICLSup = #34 = ac(accommodation in the development stage) and ac(accommodation in the delivery stage) and as(assimilation in the debriefing stage). Overall, the choices recorded in the inventory were supported by the educators' explanations and descriptions found within the interview transcripts.

Regarding the second purpose, meaningful reflections related to university educators' instructional choices, the statistics from the inventory were supported by the interview transcripts. Of the seven educators interviewed, all described the importance of how their personal dominant learning style as a first learner was shaped by their early learning experiences. This then affected how they applied their dominant learning style later in their role as a university educator when actively engaged in the three stages included within a lesson framework. Their reflections indicated that there was a lack of awareness by university educators regarding the effect their learning style had on their instructional choices within a lesson framework.

Overall, within the representative disciplines of arts, business, education, fine arts, and science, there was the emergence of a dominant learning style (*accommodation*), in both quantitative and qualitative data (triangulation).

6. Discussion, Recommendations, and Conclusions

Understanding the influence that educators' learning styles have on learning when selecting and delivering content for courses and lessons is an important aspect of teaching. It is well known that most educators in higher education do not possess formal education in curriculum development and instructional design. Hence, understanding the process of how educators use their learning styles to develop and deliver their course and lesson materials would provide insight into how higher education institutions can support those educators responsible for curriculum development and course design. As well, this knowledge can potentially be used at the global level, providing understanding of how educators from other cultures and disciplines make instructional choices and how their learning styles influence lesson development, delivery, and debriefing activities. This knowledge can provide best practice considerations for higher education institutions when developing curriculum and designing courses within the context of teaching students. The knowledge learned from this study can potentially enable educators and institutions to engage in positive social change that benefit both academic and social communities.

6.1 Implications

Pedagogical implications—First, acquiring basic and core knowledge of higher education educators' personal learning styles is knowledge that higher education institutions and educators can use to improve and enhance instructional choices within a lesson framework. When educators understand these patterns of use and subsequently their impact on lesson creation, they are better equipped with affecting changes within their lesson structure. As such, informed educators can adapt instructional choices within a lesson to increase effectiveness in teaching practices and in student learning. Second, the practice of debriefing or reflecting on a lesson after it is taught is an important finding of this research study. Including reflection as a standard practice for higher education educators so that it becomes part of their everyday teaching methodologies would provide opportunities for teaching innovation and enrichment of lesson content based on these reflections.

Theoretical implications—The outcome of the literature review indicated that the instructional theories of Bloom (1956), Gagne (1987), and Reigeluth (1978) were applied within the framework of a lesson by the educators who were interviewed. These educators provided examples of actual implementations of instructional theories as they were practiced within the classroom. Regarding learning style theorists, Kolb's (1984) ELT was applied within the EICLS Inventory (Mazo, 2008) and used as a foundational basis from which to determine educators' applications of their learning styles during a lesson. This study provides a deeper understanding of how learning styles are applied in a role (university educator) within society that affects significant numbers of individuals (students).

Empirical implications—Based on the results from the EICLS Inventory (Mazo, 2008), results indicated that the majority of higher education educators applied the *accommodation* learning style for development and delivery activities, and the *assimilation* learning style debriefing or reflection after they were completed with the lesson. Empirically, this confirmed that there is a specific dominant learning style usage pattern (#34) that is applied by educators across the disciplines that participated. There was also a clear indication that each discipline/specialty demonstrated its own dominant learning style usage pattern.

6.2 Extension of Knowledge within the Field of Higher Education

Factors that affect instructional choices include 1) the awareness of their own learning styles as they were shaped in early learning years, 2) the application of these learning styles within the context of a lesson framework, and 3) the connection between their learning styles and instructional choices through the conscious reflections of post lesson review (debriefing). In order to develop the framework, instrument, and structure of the study, the EICLS Inventory (Mazo, 2008) was developed and a set of learning styles usage patterns were created.

The *EICLS Inventory* (Mazo, 2008) was developed and applied within the context of higher education educators. This unique instrument was designed specifically for the purpose of determining how educators apply their learning styles during the framework of a lesson (development, delivery, and debriefing). As such, there is no instrument that currently exists that measures an educator's learning style within a lesson framework. The purpose for developing this instrument was to acquire and record university educators' learning styles applications and activities, which subsequently assists in understanding the relationship between educators, their learning styles, and a lesson framework. This extends and adds to the discipline of higher education, with a focus on educators' learning styles. Additionally, this instrument gathers information that results in determining individual (educator) and group (disciplines) learning styles usage patterns.

A set of *learning styles usage patterns* was created. The results from the EICLS Inventory (Mazo, 2008) were analyzed and then organized into 61 learning styles usage patterns. These patterns were derived from determining the individual educator's dominant learning styles applications within the framework of a lesson. Then, these dominant learning styles were inserted into a *coding system* that formed and defined each usage pattern. These unique usage patterns provide a structure that assists in revealing the way in which educators apply their learning styles based on instructional choices within a lesson framework. The coding system and the set of learning styles usage patterns add new knowledge to the discipline of higher education by enabling educators and researchers to determine and observe the behavior of university educators' applications of their own learning styles. Furthermore, these usage patterns provide insights into the behaviors of

groups of educators based on their teaching discipline. This knowledge can be used by higher education institutions when designing programs for faculty members for the purpose of increasing awareness of how their learning styles are applied through the processes of developing, delivering, and debriefing a lesson. Lessons are at the core of teaching and learning, providing an opportunity for educators to apply learning styles, to teach curriculum content, and to observe students who are in the process of discovering their own learning styles. Information about learning styles applications during a lesson can assist educators in unpacking the complexities of teaching and learning of both stakeholders—educator and student.

6.3 Recommendations

Recommendations regarding this study are as follows: 1) Include the use of the EICLS Inventory (Mazo, 2008) as a teaching tool for higher education educators to determine their learning styles and to understand how they are applied within a lesson framework. The resulting learning styles usage patterns can be used to assist educators in comprehending how they apply and adapt their learning styles for the purpose of adapting teaching behavior in relation to lessons; 2) Develop a series of seminars for higher education educators that increase the knowledge of learning styles, instructional design techniques, and the importance of reflection regarding their learning/teaching approaches; and 3) Create an instructional design tool that supports the processes involved in reflecting on a lesson.

6.4 Conclusions

Higher education educators bring various factors to the processes related to a lesson (development, delivery, and debriefing). One of these factors is their personal learning styles that were shaped as young learners. It is these learning experiences that educators draw upon as a resource from which to develop, teach, and reflect on a lesson that is taught. This study provides evidence that there is a relationship between a university educator's personal learning style and the consciously reflective instructional choices that they make when researching and developing the content of a lesson. As they create their lessons, they reflect on their past learning experiences that inform them what worked or did not work for their own learning purposes. Educators' learning style preferences were either translated within their own lesson creation or they were rejected based on the learning experiences they had witnessed as learners. Either instructional decision was based on their personal learning style preferences.

The relationship between an educator's personal learning styles and instructional choices can fundamentally change the way a lesson is initially perceived and understood by the educator and then subsequently taught. Understanding this relationship can be established in the third activity of a lesson, debriefing or reflecting on its content and delivery. The role

of reflection about a lesson is foundational to identifying personal learning styles through usage patterns and then adapting them to the lesson. This requires knowledge of their learning styles preferences, instructional design knowledge to understand the structure of lessons, and comprehension of the critical role that conscious reflection plays in a lesson framework. As such, a lesson involves an elaborate and complex set of knowledge modules that intrinsically work together.

Fundamentally, there is a need for university educators to seek information that will support them in making informative and effective lessons. This benefits teaching practices and student learning, which are inherent and foundational to supporting the positive social change that university educators are positioned within society to accomplish. This research study aimed to advance educators' knowledge in attaining one of society's visions and missions.

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Cracking the Cocoon: Promoting Self-Directed Lifelong Learning in EFL Pre-service Teachers in Chile Through the Guided Use of Social Media Tools

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Abstract

While is it an obvious observation that in the 21st century individuals will need to continue to learn to keep pace with the rapid changes that affect their personal and professional lives, the practicalities of doing so are daunting. Where do we begin to instill a sense of self-directed learning that leads to a lifelong pursuit of knowledge and, more importantly, how? The aim of our study was to determine the influence of providing guided support in the use of social media to a group of future English as a Foreign Language, (EFL) teachers in Chile. In this context, traditional teaching practices and cultural norms, not to mention resistance to technology adoption often stand in the way of learner agency and evolving self-directed learner identities. We focussed on pre-service teachers as a strategic step in changing these trajectories. Our results provide powerful evidence of change in this group of emerging teachers not only in increased responsibility for learning but in a metacognitive awareness of 'how' to learn – key ingredients in reaching personal and professional potential. We conclude that technology needs to be re-conceptualized as not only an information provider but as a key player in constructing self-directed, lifelong learners.

Keywords: *self-directed learning, social media, lifelong learning, Teacher Education, ICT, learner identities*

Introduction

“When education fails to keep pace with technology, the result is inequality.”

(The Economist, 2017)

In a recent special report on lifelong learning, the influential periodical, The Economist, painted a dire picture of the prospects of doing nothing about the current speed of change that is affecting most of our lives in terms of automation and knowledge development. Their foresight strongly suggests that citizens everywhere in our increasingly global community will face the disappearance at an alarming rate of traditional jobs and their own lack of skills to fit into newly evolving ones that are accompanying advances in new technologies. Lifelong, self-directed learning will become more crucial than ever before in the history of mankind, they argue. At the same time, they call for opportunities for lifelong learning that are radically different than current ones, especially if we wish to avoid perpetuating, or indeed worsening, the inequalities already existing.

Keeping pace with the changes that are surrounding us as citizens has historically been a challenge for education. Like an ocean liner, the direction of educational systems is painstakingly slow to turn. Indeed in many parts of the world, a majority of educational institutions seem to be still preparing individuals for 20th century working roles. In Chile where we work in education, such is certainly the case. Yet, as educators whose task it is to prepare students to flourish in a global community and to enjoy access to equal opportunities for reaching their potential of productivity and happiness, is it not within our responsibility in classrooms to guide them towards actions that will achieve those ends? As the writers of The Economist (2017) strongly point out: “Lifelong learning starts at school”. Those writers also add that learning to think, to develop metacognition (p. 9) and to exploit new technologies are also part of this process and reflect the ‘true’ aim of any effective educational system - to promote change.

The study we report on in this paper sought to pursue such an aim. In the context of Chile where rote learning, passive and disengaged learners, assessment-driven teaching reflecting information transfer pedagogies, as well as where inequitable access to quality education are all culturally and deeply embedded in the educational system, the need for change has become a national outcry. Our purpose was to add to initiatives in the country that are attempting to dismantle this national educational dilemma through strategically working with future teachers. Strong evidence in our own EFL field of study of the dynamic nature of identities (Norton & Toohey, 2011), i.e. changing and evolving depending on the contextual conditions, was further impetus. The questions that preoccupied us in this particular case were:

1. What influence, if any, does guided support of social networking media have on the learner identities of a group of Chilean EFL pre-service teachers?
2. How does the guided use of these technologies influence, if at all, their investment in self-directed or lifelong learning?

2. Literature Review

Some have argued that ‘ideal’ self-directed learners accept full control over their learning process and that self-directedness is an autonomous enterprise. Yet these views clearly defy postmodern perspectives of learning. Vygotsky’s (1978) foundational social cultural theory places learning squarely in the realm of a social-interactive activity and the precursor to cognition, i.e. learning. From this perspective then if learning is inherently collaborative, self-directed learners must be considered neither dependent nor independent but rather interdependent learners (Garrison, 1992). In other words, the identity of self-directed learners is tied closely to the social worlds they inhabit including the cultures of formal learning spaces.

The notion of identity and its implication in self-directed learning is particularly relevant to our study. Gee (2000) defines identity simply as *the way one is* in a particular context. Importantly, a *way of being* is dynamic based on whether the context and practices are limiting and constraining or alternatively offer enhanced opportunities for social interaction and human agency (Norton, 2011, p.417). By agency is referenced “people’s ability to make choices, to take control, self-regulate, and thereby pursue their goals as individuals leading potentially to personal or social transformation” (Duff, 2012, p. 417). Imbedded in the importance Norton places on contexts of learning, regardless of the discipline, is the potential for teaching practices to be transformative by offering learners more powerful positions than they may otherwise occupy in other social cultural contexts. A further implication is that the uptake of these powerful positions situates learners precisely within enriched conditions for investing as self-directed, lifelong learners.

Norton and many others within Second Language (SL) education (Lin et al., 2016; Thorne et al., 2015) have examined conditions for promoting empowered identities in learners through teaching practices. Increasingly, social media and networking technologies are considered to play a major role in these settings. As Thorne et al. (2015) argue: “Internet-mediated interaction, both within and outside of educational settings, has the potential to provide...learners with a range of possibilities for engaged self-representation and the construction of identities.” (p. 229). While these researchers have shown the potential of technology to be identity enhancing, many caution that teachers play an important role in the potential value of technology to promote such positive changes. Thus, depending on their choice and use of technologies, teachers can provide or deny learners with opportunities to enhance their identities within the learning context. Technologies that offer

such opportunities have been shown to be those that support community building (Freiermuth & Huang, 2012; that reduce social barriers and that promote engagement (Klimanova & Dembovsckaya, 2013). In other words, social-networking technology potentially provides the ideal conditions for building learner identities that are self-directed.

Discussions around the power of technology to change more than *the way we do* but also *the way we are*, are only beginning (Darvin & Norton, 2015). Connections that need to be drawn and pursued between enriched social cultural contexts, social networking technologies and opportunities for identity construction leading to self-directed learners have been relatively unexplored.

3. Methodology

Our study took place in two phases between September 2015 and December 2016. We chose to conduct the inquiry within the qualitative paradigm, using an Action Research methodology as a framework and classroom-based-research methods. The ethnographic tools available to us within a qualitative research paradigm served to help us unravel the complexities that typically exist in any learning context, most notably classrooms, including the one we studied. The increasing recognition of classroom-based research leading to change, where it matters, was a further driver in our decision to conduct the inquiry.

3.1 Context

Chile suffers from a deep and complex array of issues in terms of its education system. Economically, it is the most stable country in South America and is a proud member of the OECD. The latter factor has helped in defining some of the areas of the system most in need of attention. Teacher education is one of these areas. The general profile of teachers in the current school system is characterized as lacking in three important areas: firstly, acceptable English language levels; secondly, knowledge and training in the use of effective 21st century pedagogies including the use of technology for learning and thirdly, openness to change through top-down professional development. Since 2012, Ministry of Education efforts have attempted to address these issues by upgrading teacher education programs. At the heart of these initiatives is to provide quality teaching across the education system, and dismantle deep-seeded inequities within the society.

3.2 Participants

Twenty-one pre-service teachers in their first year of a four-year English Pedagogical Program took part in the study. Many are first generational attending higher education institutions. Along with the weight of financial pressure, many learners come into the higher education setting burdened by a cocoon-like upbringing that are considered tied to

highly protective, in some cases over-protective family practices dictated by cultural norms, an isolated society geographically and exposure to years of pedagogical coddling by perhaps well-intentioned teachers. As a result, many seem to lack the ability to accept responsibility for their learning, nor the know-how to learn effectively and efficiently – not indicative of strong future leaders of educational reforms, let alone lifelong learners.

3.3 Research Design and Analysis

In the initial 4-month phase of the study, the Teacher Educator (TE), and co-author in the study, met with the participants and proposed a ‘skills challenge’ to help address each of their individual learning difficulties based on skill testing results. Participants agreed to take part in daily practice of their ‘weaker’ language skill by making use of authentic materials available through the use of social media technology. They also agreed to keep an online log of their efforts in a class blog, Blogspot, and to meet regularly with the TE to discuss progress and individual challenges adhering to their Plan.

The data collection process in the first phase of the study involved using the following ethnographic tools: 1) observations from classroom interactions; 2) recorded individual and focus group interviews; 3) document analysis of the various assignments generated by the participants; 4) field notes, for example test scores plus informal conversations with the participants and other faculty. In the second phase of the study, in the fourth semester, data was collected from end-of-year individual reflections written by each of the participants. Reflective notes were also recorded over the period of the study by the teacher/researcher. Signed consent was sought from each of the participants in order to use the data collected for academic purposes. For privacy purposes, pseudonyms replaced names of the participants.

The significant data that was generated from the various data sets were analyzed on an ongoing basis during the first phase of the study using standard qualitative methods for uncovering salient themes and patterns. In the second phase, these salient themes were then cross-referenced with data generated from the analysis of the follow-up participant reflections. We acknowledge that the analysis presented here is the not sole interpretation of the data that can be applied. Also, given the space limitations, we have chosen only representative excerpts from various data sets to support our analysis and conclusions.

4. Analysis and Finding

From the analysis of the multiple data sets, two major themes that emerged suggested that technology supported changes in identities existed on two levels: 1) at the TE level and 2) at the Pre-service Student level. A deeper analysis of these themes revealed that by changing her teaching practices and her role as teacher from passive conveyer of information to supporter and guide, the TE was able to provide the ideal conditions for learners in her class to invest in taking on more agentive roles in their learning that lead to evidence of emerging self-directedness. At both levels, social networking technology was critical to these changes. In the following sections we explain the major findings on each level.

4.1 Technology Support for Self-directedness at the Teacher Educator Level

The TE reported that key to the success she had with the project was a) the encouragement and support from a more knowledgeable tech savvy colleague and b) the affordances of the technology platform used by students for recording their progress in the “Skills Challenge”. In online discussions, participants shared their challenges and ongoing success with classmates and their TE in Blogspot. The community building opportunities offered by this social networking technology were considered by the TE to be at the root of the changes that took place during the project. The TE explains the powerful role that technology played in helping to build the kinds of solid learning communities necessary for supporting self-directed identities for herself and among her students in the following extract: *“From this ‘project’ learning experience, all my classes have had a different approach: use of technological resources. It is hard, initially, to move away from the comfort zone, but once one makes use of it and sees the benefits, it is impossible to move back.”* We understand from these words that the TE is recognizing that the advantages of technology, although they imply a move away from *the way things are* and *the way one is*, i.e. as information provider and a transfer scenario, that the rewards are impressive, both personally as a professional and for her students. In other words, her identity as a TE has evolved in unison with her students’ identities. Indeed, the TE sees *“it is impossible to move back”*, suggesting strongly a continued investment in teaching practices supported by social media and networking technologies.

4.2 Technology Support for Self-directedness at the Pre-service Student Teacher Level

Turning toward the second theme that emerged in the analysis and that helped explain changes in the self-directedness of the student teachers, we draw a picture of what transpired during Phase 1 and also a year later in Phase 2, from their perspective. The data sets revealed that many of the participants witnessed a deep change in the way they viewed themselves as learners. From their testimonies, it was clear that the Skills Challenge that the TE initiated led to a new sense of being self-directed and responsible. Many expressed witnessing a movement away from being dependent toward interdependent learning. For these individuals, the change began with a sense of awareness of their strengths and weaknesses, an awareness fostered by support and encouragement from their community of teacher and classmates in the online blog. Indeed, the TE and students both attested to the Blogspot providing a unique forum for interacting and connecting between class time that was previously unavailable. Many claimed with deep conviction that this online encouragement was crucial for their sustained efforts to work on their difficulties. Another awareness that apparently influenced their continued investment in change was a sense of improvement. Several spoke of the pride they felt and the determination to continue being self-directed as their abilities in their particular difficult skill improved. Engaging online was reportedly essential to these emerging changes in awareness, determination, perseverance and feelings of community support that had been heretofore not part of their learning process. The social networking site became the interface for these influences to play a role in the oftentimes-difficult changes towards self-directedness that occurred during the inquiry. In Table 1, we provide representative excerpts from the data to support this analysis.

Table 1: Technology Influence on Self-directed Identities: Excerpts form the data

Awareness	“What I liked of this course is teacher gave us the possibility to write articles at home and upload them in the Blog, because I can’t write under pressure, I can’t think, and I can’t write correctly. Now I feel very good about myself and I hope to continue improving my English.”
Determination	“I have a more personalized education [working in the Blogspot] and I try to improve every day.”
Perseverance	My pronunciation and writing need be improved even more. I have many grammatical errors when speaking and writing, but I know that I can improve that doing the extra activities using my computer at home.”
Interdependence within Community	<p>“I have improved in my weaknesses thank to my teachers and my classmates”</p> <p>“Miss xxx was very happy and enthusiastic about the progress I had made. That of course encouraged me to continue giving my best.”</p> <p>“I have a more personalized education and I try to improve every day”</p>

A follow up data collection a year after the initial inquiry with this group of participants provides insight into the sustainability of these findings. Analysis of these data sets indicated that identity changes resulting in the online Skills Challenge initiative prevailed for many of the participants. The outward signs of a majority of these learners characterized by a growing sense of self-directedness, awareness, determination, perseverance and interdependence within community were uncovered. One of the pre-service teachers witnesses these influences in her comment on the December 2016 reflection: *“I never thought that we would be here, but I am. This is what I like and what I really want to do. So, I have to do everything that I can to reach my goal.”* Her use of “we” is significant in that it reveals the importance she places on her interconnectedness with others in her journey to succeed in her goal to become a competent speaker of English and teacher. In her words, we see the awareness of her path and the inner strength that she has to continue to learn and improve. Her determination in preparing for her role as a future teacher is clear and her realization of what it takes, in her words *“everything I can”* is obvious. Indeed, the sentiments expressed in these words represent we believe, a growing sense of responsibility and self-directedness, typically unusual among Chilean students. Similar sentiments also surfaced in many of her classmates during the longitudinal study as well. These findings speak to the powerful sustained change that was initiated through the Skills-Challenge supported by social networking technology.

5. Conclusion

As the warning cry rises for educational institutions to accept their role in preparing self-directed and life-long learners, traditional countries like Chile have further to go and more to lose through inaction. Part of what stands in the way is a clear *course of action*. The results of our inquiry we believe can add to practical responses needed to begin to respond to that question. Our findings confirm that integrating social media and networking technologies into a teacher education program can offer hope, at least for this particular group of novice teachers, through guided opportunities for them to construct the kinds of self-directed identities that lead to life-long learning. The effective use of social networking technologies as an interface for strong interdependency among a TE and future teachers was critical in terms of the positive results. We feel strongly that these results offer a model for teacher educators, indeed all stakeholders in education for exploring and documenting the use of such technologies for guiding self-directed learning in their own contexts.

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Using open software to teach resource assessment of solar thermal and geothermal energy

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Abstract

The students of the Faculties of Engineering of the University of Basque Country (Gipuzkoa-Eibar) in the last years of their studies, before becoming engineers, have the opportunity to select a block of subjects intended to enhance their knowledge on renewable energy systems. One of these subjects is Solar Thermal and Geothermal energy. These subjects are devoted to assessing the renewable energy resource, and designing optimal systems. Apart from the transmission of good practices, the focus is practical and is based on hands-on computer real-life exercises, which involves not only intensive programming using high-level software, but also the spatial representation of results. To that purpose two main open source codes are used: Octave (<https://www.gnu.org/software/octave/>), and QGIS (<https://www.qgis.org/>). Students learn how to address real-life problems regarding the geographical representation of solar radiation and low temperature geothermal resources using QGIS, and solar thermal system modelling using Octave.

Keywords: QGIS; Octave; learning by projects.

1. Introduction

During the last two years, students at Gipuzkoa-Eibar Faculty of Engineering in the Grade of Engineering for Renewable Energies (4 years) have many specialization subjects (<http://www.ehu.es/es/web/eibar>). We will expose “Solar Thermal and Geothermal Energy” (third year), because of its interest in terms of the use of open software for the analysis of renewable energy resource and its geographical and spatial distribution. We must underline that the surveys of the students about the subject are generally outstanding.

The subject is divided in two different parts, each one related to solar thermal and geothermal energy, together with a last chapter related to the coupling of both technologies. The teacher uses learning by projects techniques, which involve the practical design of solar thermal and low temperature geothermal systems.

- *Solar Thermal Energy*: The software for geographical information systems QGIS is a powerful instrument for the analysis solar radiation resources. We use satellite radiation data to evaluate the solar resource, together with LIDAR data to evaluate the shading patterns. Octave is also used to simulate the thermal behaviour of solar thermal collectors under varying thermal conditions.
- *Low Temperature Geothermal Energy*: The ability of geographical information systems like QGIS, to manipulate geographical data is very useful for the representation of lithography, and the manipulation of energy extraction surfaces.

This includes handling two groups of skills:

1. Solving real-life problems like the correct design of the solar collection field, simulating the thermal behaviour of solar collectors under varying thermal conditions, and serial/parallel connection schemes. This implies the use of high-level programming software like Octave.
2. Spatial planning and geographical characterization of available energy resources. This implies the use of a geographical information system (GIS) software.

2. Method

When students select our subject in their third year of studies they have a reasonable degree of computing programming skills and they are already somehow familiar with general purpose software like VisualBasic, Fortran or C++. Due to this initial background, it is possible for the team of teachers to design classes as a set of practical exercises within a bigger resource analysis project. The software we use in classes are Octave, and QGIS.

2.1. Octave

Octave is a high-level programming language intended for numerical computations, that can be very useful for solving sets of linear equations and dynamic models like the ones related to simulate the thermal behaviour of solar collectors. It is freely distributed under the GNU General Public License, and runs on most operating systems, like GNU/Linux, BSD, macOS, and Windows. It is largely compatible with Matlab, one of the most extendedly used numerical computation programs. It offers a fully integrated graphical user interface, and data visualization tools.

Additionally, Octave can be extended with new modules and functions already available, and the possibility of developing new functions. This way, Octave can be completely augmented and adapted to different objectives.

2.2 QGIS

QGIS is an official project of the Open Source Geospatial Foundation (OSGeo). QGIS provides a continuously growing number of capabilities provided by core functions and plugins. You can visualize, manage, edit, analyse data, and compose printable maps. Get a first impression with a more detailed feature list. This specific software for geographic information systems (GIS) purposes offers a more visual interface than R for geographical representation and spatial analysis. It can be a good complement of R to obtain a more understandable design in the presentation of maps, and to facilitate more visual operations than rough codes and scripts needed in R.

2.3 Learning by problems and learning by projects

Using Octave and QGIS to introduce concepts related to the subjects mentioned above, represents for our students a real and pragmatic way of problem solving. Taking into account Bloom's (1956) Taxonomy of Educational Objectives for Skills-Based Goals, they get a high level of expertise on 'guided response' and 'mechanism': 1) the student knows the steps required to complete the task, and 2) performs the tasks in a confident, proficient and habitual manner. The student simulates what the scientists do every day and use the logic of discovery instead of the logic of justification (Hanson, 1958). As Clement states (Clement 1988, 2008) in his deep study on scientific creativity, when dealing with a problem heuristically there is no difference between the problem solving capacity of an expert and of a student. That is, the students should know the real scientific practice, and not only the final important and supposedly finished theories (Chi et al., 1981, 1989). The state of the art in this domain has been developed very deeply in constructive problem solving via the use of analogy, visual thinking, spatial abstraction and other different heuristic instruments have been pointed out for that (Welsh 2012, Simons 1993, Newel

1972). We will show that the mentioned software is a powerful instrument to implement this heuristics understood as the art for solving problems.

3. Results: examples

3.1 Octave for solar collector simulation

Students learn to read relevant climatic information from publicly available repositories, mostly solar radiation and outside air temperature. They learn how to simulate solar collector fields, using collector performance parameters, and surrounding environmental conditions. For example, Fig. 1 shows the variation of the thermal performance of solar collectors varying incident solar radiation and temperature difference. Fig 2 shows the evolution of temperature difference in a solar collector and performance related to water flow rate.

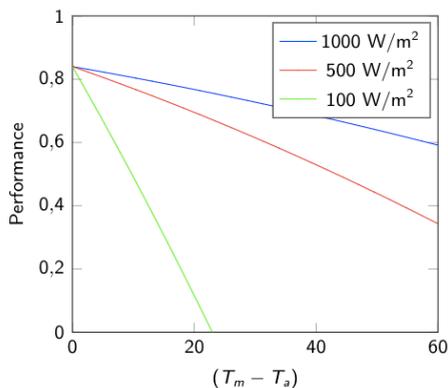


Fig. 1. Performance related to climatic conditions

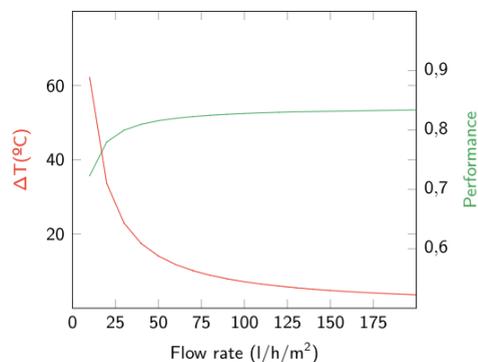


Fig. 2. Performance related to flow rate

Students learn to simulate solar collector fields, and get a deeper understanding of the parameters that influence the thermal performance of the collectors, or the outgoing temperature of water.

3.2 QGIS for solar energy resource

In this case, geographic information systems (GIS) are very useful to place the information available and relate it to the surrounding conditions. Students learn to load and use publicly available information and to manage it to obtain useful information for their projects.

For example, Fig. 3 shows the thermal radiation for the Deba river's basin, obtained from satellite data.

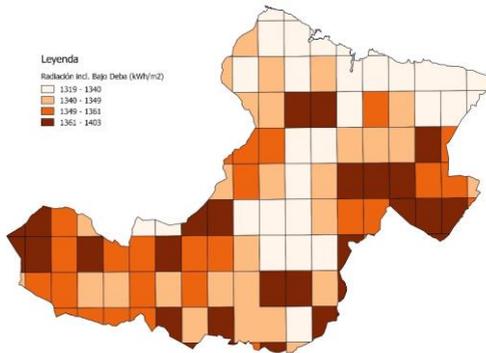


Fig. 3. Solar radiation from satellite data

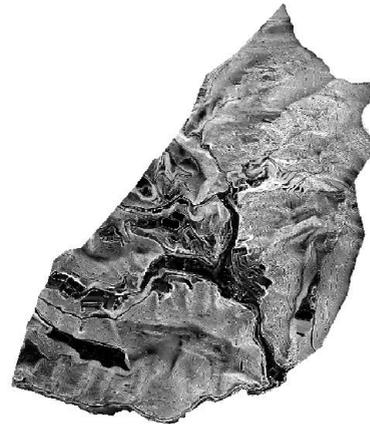


Fig. 4. Inclination map for Ermua, from LIDAR data



Fig. 5. Slope orientation for Ermua, from LIDAR data



Fig. 6. Roof shading factor for Ermua

QGIS can also be used to calculate useful data from the available information. Using the *r.sun* integrated function, QGIS can be used to load inclination maps (Fig. 4), and slope orientation maps (Fig.5) from LIDAR data, to calculate the annual shading factors for roofs, as shown in Fig.6.

3.3 QGIS for geothermal resource

Geographic Information Systems are also very useful to quantify the low temperature geothermal resource. Lithology and surface calculations are the basis of the assessment of geothermal heat transfer capabilities.

Students can download the lithological information from public resources, load it to QGIS, as shown in Fig. 7, and use it for a first assessment of the most suitable areas for geothermal systems.

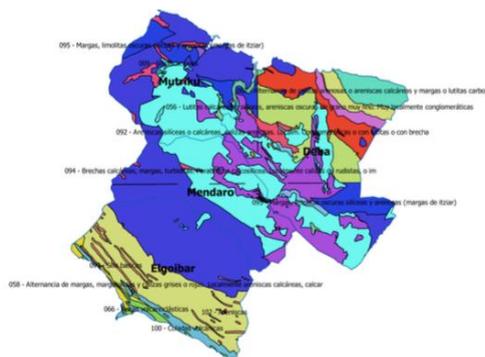


Fig. 7. Lithology for the town of Mendaró

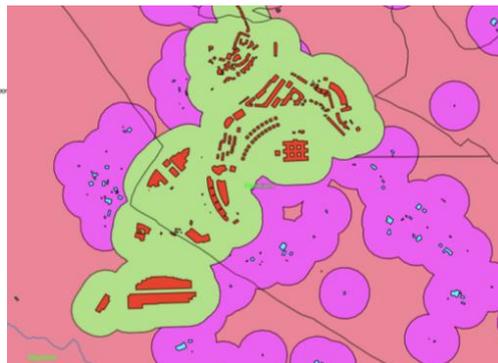


Fig. 8. Surface calculation around buildings

Surface area calculations is also very useful for the assessment of the accessible geothermal resource. Since low temperature geothermal energy is a low quality resource, it can only be exploited in the nearby of buildings. The buffering tools of QGIS can be used to evaluate the area in the surrounding of buildings, as can be seen in Fig 8. Overlapping the lithological information with the accessible area, and usual conversion factor can yield the usable geothermal potential.

4. Results in the classroom and conclusions

We have applied these learning by projects techniques in the Grade of Engineering for Renewable Energies for the last four years in the subject of “Solar Thermal and Geothermal Energy”. Taking into account that there are approximately 70 students per course we are speaking about more than 250 students, which have shown very good opinions in their surveys when they have been questioned about these subjects and the teaching methods used. For example, last years the teacher of the subject obtained 4.1 out of 5.

The introduction of the mentioned software has enhanced our learning by problems perspective with respect to previous more theoretical and expositive way of teaching. Previously the subject was focused only on learning by projects methodology, and more specifically on the final design of a solar thermal system and the final design of a geothermal system. The students would choose a location at which they would design the systems, with no additional information.

With the use of these new software tools, students can perform a first analysis in order to obtain the best roofs to install solar thermal energy, using the roof shading factor as shown in figure 6, or the best soils for geothermal applications as shown in figures 7 and 8.

Moreover, the use of Octave for solar thermal applications allows the teacher to introduce learning by problems methodology, in order to enhance the understanding of the thermal behaviour of solar collectors. The simulation of solar collectors and solar collector fields

can be used to understand the way the collectors react under severe conditions like overheating or freezing, or the importance of factors such as flow rate, outer temperature, or circulating temperature. This way, students can also compare the behaviour of different collectors, and choose the ones best suited to their needs.

As a conclusion, the introduction of these new software tools, together with the use of freely available databases, allow the teachers to broaden the scope of the subjects, introducing new learning by problems techniques, and enhancing the self-learning abilities of the students.

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Project-Based Learning and Self Directed Learning

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Abstract

This article discusses the benefits of project-based and self-directed learning to develop competency in utilizing a second language and working collaboratively. The background premise of these modes of learning is provided, demonstrating that they work well for differentiated levels and language skills and improve student competence. Some of the areas examined are intercultural and scientific, ones that require the use of specific language in context. In addition, the concept of creating projects that increase student investment and motivation to make learning more relevant is juxtaposed with a student's competency in an area after having participated in traditional approaches to learning. The overall benefit of the use of project-based and self-directed learning is that it allows the student to develop a higher skill set and greater engagement with the subject matter, producing better language and content outcomes.

Keywords: *Project-based learning; self-directed learning; intercultural communication; STEM; third space.*

1. Introduction

Project-Based Learning and collaborative work is becoming more commonplace in teaching practice. Project-based learning (PBL) lends itself well to the incorporation of technology, prevalent in our everyday lives. With PBL, students can use technological and online resources available to research, investigate, and work collaboratively. Additionally, technology allows for both autonomous and collaborative work, enabling students to succeed at their own pace and potentially avoid conflicts of perspective while researching varying contexts, and finally providing them with a medium to connect their material with other students.

The multimodal uses of technology give learners of varying levels and thought patterns a chance to learn and investigate before establishing relationships with other students. The ability of a student to work in congruence with his or her own personal style creates a comfort level to enable better cooperation on group projects. The use of projects is thought to aid students' learning to become more personally relevant and thus increase their acquisition of knowledge and generation of new meanings in the target language. It has been conjectured that projects enable students to utilize language in meaningful ways and that the inherent relevance of the material facilitates more efficient acquisition of skills that students can transfer to other contexts. This is in contrast with more traditional teaching practice, assumed to teach skills in set patterns, but not necessarily in connection with the semantic schema of the student, and also focused upon content rather than a student's learning process.

2. Theoretical Framework of Self-Directed and Project-Based Learning

The premise of Self-Directed Learning Theory is that the student learns how to learn by self-monitoring his or her own progress and attending to his or her own metacognitive skills involved in the learning process (Zimmerman & Schunk 2008). The skill set employed by Project-Based Learning and its inherent principles crosses over into the skill set utilized in self-directed learning and vice versa.

Project-based learning follows constructivist theory by allowing students to approach context and generate personal meaning in relation to that context via inquiry and research (Krajcik & Blumenfeld 2004). The following items are the principal steps of project-based learning (Blumenfeld et al. 1991; Krajcik, et al. 1994; Czerniak & Berger 2002, p. 2).

1. They start with a driving question, a problem to be solved.
2. Students explore the driving question by participating in authentic, situated inquiry- processes of problem solving that are central to expert performance in the discipline. As students explore the driving question, they learn and apply important ideas in the discipline.
3. Students, teachers, and community members engage in collaborative activities to find solutions to the driving question. This mirrors the complex social situation of expert problem solving.
4. While engaged in the inquiry process, students are scaffolded with learning technologies that help them participate in activities normally beyond their ability.
5. Students create a set of tangible products that address the driving question. These are shared artifacts, publicly accessible external. Representations of the class's learning.

Collaborative learning with a focus on contextual project allows for students to surpass differences of learning style and to find a niche for particular abilities in working with a group. Student engagement with the material in a personally meaningful way, allows for deeper understanding and connection with the material being studied.

2.1 Mutual Understanding and Intercultural Communication Project

Due to past experiences of cultural misunderstandings and difficulty maintaining collaboration when teaching mixed classes of students, as well as a lack of awareness of the harmful effects of stereotyping, creating any kind of group work or project requiring cooperation proved difficult. Even when the students did respect those from other cultures, misunderstandings arose from dissimilar premises of how to solve a problem or what process one should use to investigate and solve it. Some students had little or no experience developing research and dialogic inquiry skills.

The following paradigm was created in an attempt to encourage students to work collaboratively and to lay aside their preconceived notions of others in the class. Students were given both a problem to research and a task to carry out. Students in an adult ESL/EFL class were paired with another from a different culture and language base. Most of the students ranged in age from 17-25, with some outliers in the age range of 25-50. If students were from the same country, then each one was paired with someone from a different town, religious base, or cultural heritage. Students were given a rubric requiring research, evidence of investigative skills, and a presentation. The basic task, (basic so that it could be adjusted for student level and proficiency), was for each student to research as much as possible about the home culture of their partner, albeit with a caveat. First, students worked collaboratively to create questions about their partner's home culture.

Once the questions were agreed upon as a whole class, and once students had a chance to object to anything too personal or uncomfortable to answer, students started by researching their partners' home culture via the Internet and other resources.

After all research is gathered, the partner then presents his or her research to the partner of that home culture. The partner then informs the partner conducting the research of any information that does not apply to his or her personal life and culture. After the partner has chosen the applicable aspects of home culture, he or she then teaches the researcher how these aspects apply to personal and daily life and explains anything not well understood. The partner records information for his or her presentation. The same process is then followed in reverse with the other partner.

On the day of presentations, students follow a rubric they were given to show what points to cover and in what manner. The crucial finale to the exercise is that students can only present what their partner has approved, thereby avoiding guessing, stereotyping, misunderstanding, and conjecture. The presenting student can only present what is relevant and true in their partner's home culture. This project has been done with three different classes: one low intermediate, one intermediate, and one advanced intermediate. All research was conducted in the second or target language.

2.2 STEM Project on the Lifecycle of Plastics

Similar to the steps outlined in the description of intercultural communication, the Project-Based Learning approach also works effectively in other areas of education such as Science, Technology, Engineering, and Math, or STEM as it is currently referred to. Many university intensive English programs not only teach ESL/EFL, they also provide specialized courses like English for Business, Law or Science and Technology. It is the last area, Sci-Tech, that will be the focus of the following section.

The students in these courses have as their aim to enter undergraduate or graduate Sci-Tech programs in U.S. universities. They come from a variety of countries and cultures, and STEM becomes the "third space" as mentioned by Homi Bhabha (2006), or a hybrid between two cultures or histories. While this term is applied loosely here, it can be imagined as the overlapping space of two or more circles in a Venn diagram. The students from different countries or cultures are those circles, and the area in which they overlap is their interest in and passion for science. It is this space that unites them in a Sci-Tech program and the impetus that drives them to find a real-world problem and search for a creative and viable solution.

The five steps introduced in the Theoretical Framework are the same ones that are followed in PBL in the sciences. This constructivist approach allows students to identify, explore, engage, collaborate, research, and finally, arrive at a solution as a group. An example of a

STEM project done in a class of adult ESL/EFL learners at an advanced level was one on the lifecycle of plastic. It began with a question about why students at the language center threw their plastic containers into the trash can instead of the recycling bin. The students were divided into groups of 3-4 of mixed linguistic and cultural backgrounds. After discussing the topic, they decided on several ways to address this question. As a class, they first devised a survey to administer to other students at the language center to find out why they didn't recycle their items and administered it to 5 students each in their free time. Then they combined the results and found that the main reason was that students didn't know what could be recycled because the sign on the bin simply said "Recycle".

One group decided to look at the university's website as their second step and found a "Sustainability" page <https://www.bu.edu/sustainability/> that explained what could be recycled, how much waste the university produced each year, and how much they had begun to save by initiating sustainable practices. Another group visited the dining hall in the student union and saw that recycling stations were clearly labeled and got the idea that the same could be done at the language center. Yet another group looked at the trash pick-up areas and saw that the trash and recyclable items were clearly separated so that they could be collected and properly disposed of. In this stage of the project, students were participating in "authentic, situated inquiry processes of problem-solving" as noted in the Theoretical Framework.

The third stage of the project was to find solutions to their question by engaging in collaborative activities. One group wrote to the Office of Sustainability and to ask if a speaker could come to class to talk about the topic. There happened to be student volunteers for just such a purpose, and one agreed to come and talk about the myriad ways that students could save energy and resources as well as the ways the university was trying to do so. After his talk, the groups decided to make recycling signs so that other students could understand exactly what materials could be put in the bin. They also made a personal commitment not to buy water in plastic bottles, but to use their own containers and refill them from the purified water stations around the university. After looking online for clip art, each group made graphic visuals that delivered a clear message about what could be recycled. They laminated the signs and asked other teachers at the language center if they could give a five-minute talk about recycling in their classes, which most welcomed with enthusiasm. The signs that the students fastened on the recycle bins and the talks they gave to their peers served as publicly shared artifacts and visible representations of the students' learning.

Finally, each group did a research project on where the plastic goes if it is not recycled. One group spoke about the trash heaps in certain countries where the poorest of the poor go to scavenge. Another spoke about the ocean gyres and the objects that float in them and the tiny pieces of degraded plastic that fish and birds ingest. Yet another spoke about the

unsightly trash heaps on riverbanks and seashores that contaminate waterways and prevent people from enjoying nature. On a positive note, one group spoke about “plastic fashion”, or the use that artists and designers are making of recycled materials.

Although some of the students had been strangers to each other at the beginning of the term, by the end of this PBL cycle, which lasted approximately six weeks, they were very close. Because they had thought of a question that was part of their daily lives at the language center and taken steps to research it collaboratively at the university level, they felt empowered. When they had learned enough to make a decision to act upon their new knowledge, both by changing their personal behavior and by educating their fellow classmates, they felt like they were indeed part of the scientific community. They had collaborated on different aspects of inquiry, searched for answers from knowledgeable sources, generated their own solutions, and disseminated both the knowledge they had acquired and the solutions they had arrived at to a wider audience.

3. Conclusion

The intercultural project yielded excellent results in all three classes, based on student self-report and feedback to others in the class. During the presentations, the listening partners expressed positive emotion and pleasure with how they were represented, and how much their partners had learned about their home and life. Students were surprisingly respectful and humorous when dealing with unknown facts, and some even chose to give a mini language lesson during their presentations. Of note from a pedagogical point of view was the overall cohesion of the class, the increase in fluency and participation in class discussions, as well as the recall of the research conducted.

After these presentations, students appeared more bonded and earnestly invested in maintaining a positive class atmosphere. The assumption is that the effort to understand and portray another’s culture in such an enthusiastic and deferential manner raised the expectations of classroom culture and offered a chance for students to actually “see” their classmates from the others’ point of view.

In addition, the project allowed for adjusted pace of varying levels of target language proficiency in the class and in addition, made the language acquired as well as the learning process personally relevant. An added bonus was the increasing awareness of students’ metacognition and the research process. Because students are sometimes forced to work in groups or with partners with poor results, this project allowed students to work independently at first, adjust their pace, and further develop mindfulness of themselves as learners before working collaboratively. The students had ample opportunity to self-regulate and to further these skills in meeting the goals and deadline of the project.

The STEM project also helped the students to bond through shared inquiry into a problem identified by the group, interactive research online and at the university, and collaborative generation of solutions that were shared and publicized. The acquisition of specialized scientific vocabulary from Internet searches and readings, contact with university offices and representatives, and deeper research into their chosen topics was much more effective than learning lists of lexical items for later testing. During their final presentations, they were teaching each other about a related yet unknown topic, which generated enthusiasm on the part of both the speakers and listeners.

During this PBL cycle, the students felt as if they were acting like scientists by driving the process of inquiry forward on their own initiative. Some students have kept in touch with the instructor and each other as they moved on to different universities in the U.S. to become real scientists who will find actual solutions to current problems and improve life on earth.

In contrast to project-based learning, classes where more traditional methods of teaching are used, the classroom dynamics are more related to and reflective of the dominant and subordinate personalities of students and the perception of the dominant culture. When students work in pairs for short exercises or even take part in discussions, they never seem to develop positive rapport and collaborative skills, unless they learn to respect and care about each other outside of class. The use of projects, in particular ones that increase awareness of identity and purpose and provide opportunities to bond and progress, appear to make a great difference in class dynamics, motivation to learn, and development of proficiency in a language.

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Project *Learn in English*: A CLIL experience at the Faculty of Science of the University of Extremadura

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Abstract

The internationalization of European higher education is one of the guiding pillars of the Bologna Declaration, that aims to promote intra European student mobility and cooperation. Although different activities are needed to stimulate this mobility, Content and Language Integrated Learning (CLIL) has become one of most important ones, since students learn a new language through content that they consider relevant for their future. Inspired by this idea, the Spanish University of Extremadura (UEx) has developed a strategic plan for the period 2014-2018 explicitly embracing bilingual teaching as one of the main actions to ensure the integrity, innovation and quality of its teaching. This action has recently materialized into the project “Learn in English” that promotes the design of courses completely taught in English in different centres of this University. This work describes the particularities and results of this project in the Faculty of Science of the UEx, where three different degrees have been involved: Physics, Chemistry and Chemical Engineering.

Keywords: *Higher education internationalization, Content and Language Integrated Learning, Bilingual teaching, Faculty of Science, University of Extremadura.*

1. Introduction

Universities have always been international institutions, with an openness to faculty and student flows and to borderless knowledge creation and dissemination (Albacht and Salmi, 2011). However, this international dimension has deeply changed over the centuries into the forms and approaches that we can witness today. These range from the mobility of and competition for students, teachers and scholars; export of academic systems; research cooperation; knowledge transfer and capacity building; student and staff exchange; internationalisation of the curriculum and of learning outcomes; and cross-border delivery of programmes, projects and institutions; to virtual mobility, digital learning and collaborative online international learning (de Wit *et al.*, 2015). The current concept of *internationalization of higher education* takes form during the past three decades, and can be defined as *the process of integrating an international, intercultural, or global dimension into the purpose, functions or delivery of post-secondary education* (Knight, 2008).

The promotion of intra European student mobility and cooperation was a core objective in the creation of the European Higher Education Area (EHEA), and it was also one of the six core objectives of the intergovernmental Bologna Declaration of 1999. One of the strategies that has turned out to be more successful to stimulate this mobility is the *Content and Language Integrated Learning (CLIL)*, a methodology for learning a subject through the medium of a foreign language that has been identified by the European Commission as a major tool to achieve the Union’s language learning goals (Commission of the European Communities, 2003).

In consonance with this trend, the Spanish University of Extremadura has recently developed a strategic plan for the period 2014-2018 that explicitly identifies bilingual teaching as one of the actions that must be promoted to ensure the integrity, innovation and quality of its teaching. This action became real during the academic year 2015-16, in the form of the project *Learn in English* that establishes the working framework to design several courses completely taught in English in five centres of this University: Faculty of Science, Faculty of Economics, School of Industrial Engineers, Polytechnic School and Faculty of Veterinary.

This work presents the particularities of the implementation of this project in the Faculty of Science, and summarizes the results obtained in terms of general acceptance and level of satisfaction expressed by the students.

2. Project general overview

The project *Learn in English* aims to establish the reference framework that will provide all the tools, procedures and qualified personnel needed to ensure a high quality bilingual teaching in the University of Extremadura (Spain). This project contemplates on the one hand the instruction and support for teachers to help them acquire the necessary English competences, and on the other hand due recognition to this effort. The strategic planification of the project has been divided into three stages:

Stage 1. Academic year 2014/15: Identification of all the centres that will be part of the project. These centres had to meet three requirements:

- The Centre is interested in bilingual teaching and has manifested this interest in the past (mainly through the promotion of English teaching initiatives)
- The Centre's faculty willing to participate must credit a certain English level. This level is B2 in this first stage, but will eventually become C1 in the third stage.
- All the teachers involved must have enough free hours in their teaching load (thus avoiding the need for new contracts)

The five centres meeting all these requirements, and therefore finally chosen, were the Faculty of Science, Faculty of Economics, School of Industrial Engineers, Polytechnic School and Faculty of Veterinary.

Stage 2. Academic year 2015/16: Design and teaching of the bilingual courses. An important constraint imposed by the University is that all these courses must also be offered in Spanish. In this stage the faculty participation in this program is recognized in a double way:

- All English-taught courses contribute with an extra 25% on the instructors teaching load.
- English teaching is considered an important merit in the application for the regional salary supplement.

During these first two stages, free instruction was provided to all the participants interested, also covering the C1 level examination fees.

Stage 3. Academic years 2016/17 and 2017/18. All the participants are expected to have a C1 level at the beginning of this stage. If they have not achieved this level, they can still participate in the program but will not benefit from the recognition measures described above. During this last stage, teachers are encouraged to participate in innovative teaching programs aimed at increasing the offer of bilingual courses.

The practical implementation of this project in the Faculty of Science involved three of the nine Bachelor degrees being currently taught in this centre: Physics, Chemistry and

Chemical Engineering, with a total offer of 18 courses distributed as shown in Table I. These degrees were selected from the nine bachelor’s degrees and six master’s degrees offered by this centre following the same criteria described above.

3. Results

3.1. Acceptance

Table 1 shows the number of students enrolled in both the Spanish and English versions of the courses offered in the context of the *Learn in English* project. As can be seen in this table, results are very different in the three degrees involved. The percentage of students following the English courses in the Physics degree is 20.9%, and a similar percentage is observed in all the courses of this degree, with the exceptions of *Advanced Solid State Physics* (0%) and *Laboratory of Electronics* (78.6%). This figure drops dramatically down to 4.9% in the Chemical Engineering degree, and further decreases to an anecdotal value of 0.8% in the Chemistry degree, where only one of the five offered courses had students.

Table 1. Number of students enrolled in the bilingual courses (2015/16)

	Course	Num. Students	
		Spanish	English
Physics	Thermodynamics I	23	4
	Mechanics and Waves II	22	5
	Thermodynamics II	29	6
	Electromagnetism	28	5
	Quantum Physics I	20	5
	Electromagnetism II	24	5
	Advanced Solid State Physics	2	0
	Physics of Fluids	19	4
	Laboratory of Electronics	3	11
	Total:	170	45
Chemistry	Basic Inorganic Chemistry	42	0
	Extension of Inorganic Chemistry II	40	0
	Advanced Analytical Chemistry	24	0
	Physical Chemistry applied to Industry	15	1
	Química Inorgánica Industrial	9	0
	Total:	130	1
Chemical Engineering	Introduction to Chemical Engineering	22	2
	Environmental Engineering	16	1
	Chemical Reactors II	29	1
	Lab in Chemical Processes	10	0
	Total:	77	4

3.2. Satisfaction

Students satisfaction has been assessed by means of a survey that they have to complete at the final of the semester, after the examination period. This survey is composed of some questions grouped into two main blocks, a first one designed to obtain some information about the students English background, and a second one intended to evaluate the satisfaction of these students with the teaching experience. Unfortunately, only 20 of the 50 students enrolled in the English courses participated in this survey for different reasons (for example, no survey was handed out in the courses with just one student). Table 2 summarizes the results obtained in the most representative questions included in this second block.

Table 2. Students satisfaction results (2015/16)

	Easy	Not difficult	Difficult	Very difficult
In your opinion, following the English lessons has been...	25%	75%	0%	0%

	Yes, both with the technical and the English contents	Only with the technical contents	Only with the English contents	No, neither the technical nor the English contents
Are you satisfied with the course contents?	100%	0%	0%	0%

	Yes	No	Don't know
Would you be interested in attending other courses of your degree in English?	75%	0%	25%

As can be see, the satisfaction of the students with this CLIL experience can be considered very positive, since 100% of them (20 out of 20) declared that following the English lessons had been 'Easy' (25%) or 'Not difficult' (75%) and, most important, that they were satisfied with both the technical and the English contents. Also, 75% manifested their interest to participate in other English-taught courses.

4. Conclusions

This work has presented the main features and results of a bilingual teaching project in the Faculty of Science of the University of Extremadura. This project has been structured in three sequential stages to (1st) identify the target degrees that will be part of the project, (2nd) design and start teaching the bilingual courses, and (3rd) consolidate and increase the offer of English-taught courses.

The results obtained in the academic year 2015/16 in terms of students acceptance and satisfaction have been then presented. We have seen that students acceptance, defined as the percentage of students enrolled in English-taught courses, has been very different in the three degrees involved, reaching values of 20.9%, 4.9% and 0.7% in the Physics, Chemical Engineering and Chemistry degrees respectively. In all cases students satisfaction, measured through their responses to three questions included in a final survey, can be considered very positive and encouraging.

Finally, it is important to remark that we are now starting the third and last stage of the project. This stage expands through the current (2016/17) and next (2017/18) academic years, during which the offer of bilingual courses is expected to increase. It will be necessary to analyse the evolution of the figures above to assess the actual success of the project.

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