> HEAd'19

5th International Conference on Higher Education Advances

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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 fifth edition (HEAd'19) was held in Valencia, Spain during 25-28 June 2019. This preface gives an overview of the aims, objectives and scope of HEAd'19, 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'19

This volume contains the selected papers and posters of the Fifth International Conference on Higher Education Advances (HEAd'19), which was held in Valencia, Spain during 25-28 June 2019. This fifth 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 Paloma Merello, who led a team of 206 program committee members representing 44 countries in all five continents. Following the call for papers, the conference received 387 full paper submissions from 58 different countries. All the submitted papers were reviewed by at least two program committee members under a double blind review process. Finally, 95 papers were accepted as full papers for oral presentation during the conference. This represents an overall full paper acceptance rate of 24.5%, the most selective acceptance rate across all the editions. This selection ensures a high-quality program which is greatly valued by the research communities. Additionally, 32 submissions were accepted as short papers and 35 as poster communications, all of them receiving high review scores and published by UPV Press in this volume. The program committee chair congratulates all the authors for having their papers accepted in the proceedings of such a competitive conference.

HEAd'19 also featured three keynote speakers that overviewed important and actual topics: Dr. David Menendez Alvarez Hevia (Manchester Metropolitan University) talked about the challenges related to the marketization of the Higher Education. The talk by Dr. Cecilia Chan (The University of Hong Kong) focused on new approaches to assess skills. Finally, Dr. Amparo García Carbonell (Universitat Politècnica de València) dealt with the use of simulation and gaming in higher education.

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) 2018. 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.

This year, the first PHELC workshop was collocated with HEAd'19. This workshop, led by Ann Marie Farrell and Anna Logan, focused on giving insights into teaching large classes from an evidence-based, higher education practice perspective.

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Assessment of Creative Thinking of Hong Kong Undergraduate Students Using the Torrance Tests of Creative Thinking

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Abstract

Creativity has been a key graduate attribute and transferrable skill for the universities nowadays. A better understanding of freshmen students' level of creativity thinking facilitates the cultivation of the ways for nurturing the development of creativity in students throughout their university education studies. The purpose of this study was to investigate creative thinking abilities of first-year undergraduates in Hong Kong using the Torrance Tests of Creativity Thinking (TTCT) – a commonly known assessment for creativity. A total of 492 first-year undergraduates at a university in Hong Kong were asked to complete TTCT Figural Form consisting of picture construction, picture completion and lines activities. Generally, the creative potential of Hong Kong undergraduates was well above the average. The students demonstrated their abilities in generation of a number of relevant ideas (fluency), producing novel responses (originality), abstract thinking (abstractness of titles), and open-minded thinking (premature closure). They exhibited creative strength of, for example, flexible imagination, thinking with senses, and thinking beyond boundaries. However, students' elaborative thinking, metaphorical-thinking and sense of humor had a lot of room for improvement. Based on the assessment results, some implications on the possible institutional strategies for nurturing creativity among students during university education were discussed.

Keywords: Creativity; assessment; higher education; institutional research .

1. Introduction

In Hong Kong, the development of creativity of students becomes one of the objectives in higher education for the 21st century, based on the latest trends and demands of society's needs (Education Commission, 2000; 2001). There are numerous fastest-growing jobs and emerging industries relying on creative capacity of employees to spot new and unforeseen business opportunities. Developing, implementing and communicating new ideas to others; and being open and responsive to new and diverse perspective are typical necessary creative and innovation skills at work nowsadays (Piirto, 2011). Such employment market tendencies highlgiht the need for university institutions to develop and underand the abilities of their students in creative thinking. Creativity thus acts as a key graduate attribute and transferrable skill for the four-year degree education in universities.

Measuring creative thinking abilities of students is increasing in education in general (Bart et al., 2017). The Torrance Tests of Creativity Thinking (TTCT) is a widely used assessment for creativity in different cultures and populations (e.g. Higuchi et al., 2013; Kim, 2017; Runco et al., 2010; Van Goch, 2018; Yarbrough, 2016). It has also been utilized for research purposes in Hong Kong with school children (Kam, 2009; Rudowicz et al. 1995). The TTCT was determined as the significance measure of creative potential of individuals, as its construct validity, convergent validity, discriminant validity, predictive validity, and test-retest reliability were comprehensively examined in prior studies (Kim et al., 2006; Kim, 2011; Yoon et al. 2017). The creative thinking abilities as measured in the TTCT referred to the "constellation of generalized mental abilities that are commonly presumed to be brought into play in creative achievements" (Scholastic Testing Service, 2017a).

A thorough understanding of freshmen students' level of creativity would help to better point out the ways for facilitating and fostering the development of creativity amongst the students during their university education. Taking Hong Kong as a cases study, the purpose of this study was to examine the degree of creative thinking abilities of first-year undergraduates as measured by the TTCT. The creativity measures of the Hong Kong sample were then compared with those from the norms. Based on the assessment results, some implications on the educational strategies for fostering creativity in students were discussed. The findings of this study would be a useful reference for instructional planning and setting out important curricular elements related to creativity in university programs according to the creative potential of intake undergraduates.

2. Method

2.1. Participants

A total of 492 first-year undergraduate students at a university in Hong Kong voluntarily participated in this study. The mean age of the students was 17.91 years (SD=0.68 years). The proportions of males (50.20%) to females (49.80%) were approximately equal. Around three quarters of the participants (74%) were local Hong Kong Chinese, and the remaining 26% participants were from other regional areas. The participants came from different disciplines including business, engineering, science, and social science.

2.2. Instruments

Torrance Tests of Creative Thinking (TTCT) Figural Form A consisting of three activities of picture construction, picture completion and lines was used in this study. The responses to the TTCT were drawings. The Figural Response Booklet A, a soft black lead pencil and a rubber were provided for the participants to complete the three activites.

2.3. Procedure

The Figural Form A was administered to the participants following the TTCT Directions Manual (Torrance, 2016). The participants were asked to complete the picture construction, followed by the picture completion and then the lines activity; each of which was completed in 10 minutes. The picture construction task required drawing of a picture based on a curved shape and creation of a title for the drawing. The picture completion task demanded the participants to complete 10 figures that appeared as incomplete and to give titles for the figures. The lines task asked the participants to draw as many figures as possible from the pairs of straight lines and to add titles for the figures.

2.4. Measures

The test responses of the participants were sent to the publisher of the TTCT for scoring. The Streamlined Scoring Guide (Scholastic Testing Service, 2017b) provided the details of the scoring mechanism. Two composite measures of 'grade-based average standard score' and 'grade-based creativity index' and six subscales of fluency, originality, elaboration, abstractness of titles, resistance of premature closure, and creative strength were adopted in this study. Fluency, originality, elaboration, abstractness of titles, and resistance of premature closure were called creativity dimensions (Table 1). Creative strength referred to the thirteen criterion-referenced measures such as emotional expressiveness, storytelling articulateness, extending or breaking boundaries, and richness of imagery (Table 2).

Table 1. Five TTCT creativity dimensions (Scholastic Testing Service, 2017b).

Dimension	Description
Fluency	Ability to generate large number of relevant responses
Originality	Ability to produce novel or unusual responses
Elaboration	Ability to produce new response by adding tweaks to existing ideas
Abstractness of title	Ability to go beyond a concrete physcial description
Resistance of premature closure	Ability to keep open-minded and refrain from making premature conclusion

Table 2. The thirteen aspects of creative strength (CS) (Scholastic Testing Service, 2017b).

Item	Description
CS1. Emotional expressiveness	Feelings and emotions communicated through titles and drawings
CS2. Storytelling articulateness	Putting things in context and creating an environment for an object
CS3. Movement or action	Indicators of movement such as running, dancing and falling
CS4. Expressiveness of titles	Titles that go beyond simple description
CS5. Synthesis of incomplete figures	Combination of two or more incomplete figures
CS6. Synthesis of lines	Combination of two or more sets of lines
CS7. Unusual visualization	Visual perspective other than the static, upright, straight-on view
CS8. Internal visualization	Objects with visible interior, cross-section, etc.
CS9. Extending or breaking boundaries	Going beyond the limits or boundaries of the parallel lines
CS10. Humor	Portraying something comical, funny or amusing
CS11. Richness of imagery	Responses showing variety, vividness, liveliness, intensity, etc.
CS12. Colorfulness of imagery	Responses exicting to the senses, emotionally appealing, unreal, etc.
CS13. Fantasy	Figures in myths, fairy tales, science fiction, etc.

3. Results

3.1. Composite measures and five creativity dimensions

The standard scores for each of the measures of creativity assessed by the TTCT were used in this study. The standard score was a normalized standard score reported on a scale with a mean of 100 and a standard deviation of 20 (Scholastic Testing Service, 2017b). The composite measures of creativity index and average standard score of the students were 116.30 and 102.02 respectively. The five creativity dimensions were examined for studying specific creativity-relevant skills. Among the five creativity dimensions, the mean of originality was highest (108.05), while elaboration was the lowest (89.97). The mean scores for fluency, abstractness of titles, and resistance of premature closure were 104.14, 102.05, and 105.84, respectively. The standard deviation on the creativity dimensions showed that individual difference of each dimension was in the following descending order: abstractness of titles (20.42), fluency (19.98), resistance of premature closure (19.48), originality (19.07), and elaboration (16.88).

3.2. Creative Strength

The classification levels of creative strength (CS) aspects were also examined in this study. Regarding items CS1 (Emotional expressiveness), CS4 (Expressiveness of titles), CS8 (Internal visualization), and CS13 (Fantasy), 45%-51% of the students indicated level of some evidences of these strength aspects.

For items CS2 (Storytelling articulateness; 75.81%), CS3 (Movement of action; 87.20%), CS9 (Extending or breaking boundaries; 77.24%), and CS12 (Colorfulness of imagery; 80.28%), more than three quarters of the students in this study showed repeated evidence of these strength aspects. For items CS7 (Unusual visualization) and CS11 (Richness of imagery), 50.61% and 40.04% of the students demonstrated repeated evidence respectively.

However, for items CS5 (Synthesis of incomplete figures; 90.24%), CS6 (Synthesis of lines; 88.62%), and CS10 (Humor; 70.53%), most of the students showed absence of evidence of these creative strength aspects in the TTCT.

3.3. Comparison with norm group

A comparison was made between the Hong Kong results and those from the norms of the TTCT. The normative sample consisted of 1,936 American students at or above Grade 13 (Scholastic Testing Service, 2017a). The creativity index, average standard score, creativity dimensions, and creative strength were comparable to norm percentiles which informed the participant's rank compared to the norm average (mean percentile, M=50). Participants' creativity Index (M=54.49; SD=28.15) and average standard score (M=54.49, SD=28.15) were above average of the norm group. Of the five creativity dimensions, the scores for

fluency (M=56.32, SD=29.12), originality (M=61.66, SD=27.71), abstractness of titles (M=53.13, SD=29.53), and resistance of premature closure (M=58.36, SD=28.52) were above average, but the score for elaboration was particularly low (M=35.06, SD=24.78) as compared to the norm group.

4. Discussion

The creative potential of Hong Kong undergraduates was generally well above the average. This study revealed that the students tended to be good at producing a large number of relevant ideas (fluency dimension) and uncommon responses (originality dimension); abstract thinking (abstractness of titles dimension); and open-minded thinking (premature closure dimension). However, the capacity of students to expand and enrich existing ideas (elaboration dimension) was not good as compared to the other four dimensions.

With respective to the creative strength, this study showed that the Hong Kong undergraduate students demonstrated some evidences in flexible imagination – generation of ideas from different angles and perceiving a common object or situation in different ways (internal visualization and unusual visualization), and disregarding exist norms in unrealistic thoughts (fantasy) (Kim, 2017). The students also exhibited their abilities in thinking beyond the limits or boundaries (extending or breaking boundaries), thinking with senses such as sight, sound, smell, taste, touch and feel (colorfulness of imagery and emotional expressiveness), thinking with movement or action, creating vividness and sharp ideas with a lot of details (richness of imagery), and storytelling articulateness.

However, the Hong Kong undergraduate students lacked of capability to recognize relationships among rather diverse and unrelated elements (synthesis of incomplete figures), and capability to identify possibilities that majority of people assume have been closed and under restrictive conditions (synthesis of lines). This indicated that the students were generally absent of evidence of the creative strength of metaphorical-thinking for bridging conceptual gaps to view ideas from new perspectives (Kim, 2017). Rudowicz and Yue (2000) revealed that humorous was not in Chinese conceptions of creativity. In this study, the Hong Kong undergraduate student sample which was dominant with Chinese was found to be deficiency of sense of humor – the quality of portraying their works and ideas comical, funny, playful and amusing.

Creative thinking has been placed at the core of knowledge economy and most work these days with significant economic value requires creativity. The findings of creative potential of first-year undergraduate students in this study indicated that administrators, educators and all other practitioners should further develop students' creative abilities in particular in elaborative, metaphorical and playful thinking throughout their university education. For example, (i) practitioners teach creativity directly by equipping students with relevant

creative thinking models and techniques to improve creative thinking skills in curricula and co-curricular programs. (ii) Institutions can help students develop their competence for creativity through teaching strategies such as cooperative learning which was found to enhance elaborative thinking of students (Palmer et al., 2016). (iii) Institutions should also put more effort to cultivate a culture of creativity on campus and nurture a creative learning environment. This would allow students to be free from the pressure and fear of failure during creative process, and be comfortable in trying to explore possibilities, experiment with amusing ideas and witness creativity in action.

5. Conclusion

This study examined the creative thinking abilities of first-year undergraduates in Hong Kong using a commonly known assessment for creativity, the Torrance Tests of Creativity Thinking (TTCT). The creative potential of Hong Kong undergraduates, in general, was well above the average. The students showed their capabilities in generation of a number of relevant ideas (fluency), producing novel responses (originality), abstract thinking (abstractness of titles), and open-minded thinking (premature closure). They also demonstrated creative strength of flexible imagination, disregarding exist norms, thinking beyond boundaries, thinking with senses, richness of imagery, and storytelling articulateness. The elaborative thinking, metaphorical-thinking and sense of humor of the students, however, needed to be enhanced. Implications on the possible strategies for nurturing creativity in students were discussed, and the strategies consisted of three main areas namely creative atmosphere of institution, curriculum design and teaching methodologies. The results and implications of this assessment would become a reference for administrators and educators to develop students' creativity during university education.

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Flipped Classroom Evaluation using the Teaching Analysis Poll

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Abstract

The increasing digitalization is a challenge for universities. Therefore, electronic teaching is experiencing a boost. Flipped Classroom is a special form of digital teaching is. Here, the basics are taught via online content and are interactively deepened in presence phases in class. For this quite modern variant of blended learning, there are numerous case descriptions in research with different evaluations available. However, a systematic examination of the evaluation of this form of teaching has not yet been carried out. The aim of this paper is, therefore, to diminish this research gap and to present the model of the Teaching Analysis Poll (TAP) as a systematic and easy to handle evaluation method in the Flipped Classroom. After a short review of recent research in the corresponding areas, we give a systematic overview of evaluations of Flipped Classroom. We introduce from the example of a Flipped Classroom Course the application of TAP as an adequate evaluation format.

Keywords: Flipped Classroom; TAP; Evaluation; Case Study.

1. Introduction

Digitalization is a major challenge of our time, which is why the use of digital media plays a special role in university teaching. The implications of digital teaching events are discussed in many ways in academia (Bender, 2016). In addition to advantages such as independence from time and space and ubiquitous availability, disadvantages such as the reduction of contact times, loss of control in the transfer of knowledge and the loss of important meta-competencies are also mentioned as arguments for and against digital teaching (Jacot, Noren, & Berge, 2014). A Flipped Classroom (FC) provides the advantages of digital teaching and avoids the disadvantages. Within a flipped or inverted classroom, the basic content is taught at home via online material (e.g., videos) and the in-class time is used for the training of deeper understanding and application. As the concept is rather new and still developing, a special emphasis should be put on the quality of education and permanent improvement. Systematic evaluations could achieve this goal (Scriven, 1996). The number of research articles dealing with the topic is massively increasing during the last years. Many of them focus on case description and analysis (Bishop & Verleger, 2013). Often information about the evaluation of the FC is provided. There is a great variety of FC approaches and at the same time no consistency regarding the way how to evaluate the FC classes (Vogelsang & Hoppe, 2018). This is why there is still a need for an evaluation procedure that enables a comparison and common understanding of the different FC approaches while at the same time doing justice to the heterogeneity of FC approaches. The paper aims at the systematic examination of the teaching analysis poll (TAP) as a method for systematic FC evaluation that seems to show great promise for fulfilling these requirements. A TAP is a structured, moderated group discussion, aiming at a qualitative evaluation of the quality of the support provided to the learning process. We will define the concepts of TAP and FC and give a summary of actual FC evaluations based on findings from the literature. Afterwards, we will introduce the TAP as a method for FC evaluation. We demonstrate the feasibility by an undergraduate class. Furthermore, we will present and discuss the results and mention conclusions as well as the limitations of the research.

2. Teaching Analysis Polls for Evaluation

The Teaching Analysis Poll has its roots in the tradition of midterm evaluations that developed in response to the often unsatisfactory end-of-semester evaluations that mainly provide quantitative data and don't perceivably lead to teaching improvements, especially from the current students' perspectives who often don't believe that the evaluation results are taken seriously by the teachers (Frank, Fröhlich, & Lahm, 2011). Clark and Redmond (1982) proposed Small Group Instructional Diagnosis (SGID) as a method to bring about formative feedback from the students to the teacher. TAP, as typically practiced in German universities, is a streamlined variant of SGID. The following is a usual sequence:

1. The teacher and the consultant (usually from the universities teaching center or the like) make an appointment for a course session during which the TAP is to be conducted.
2. The consultant conducts the TAP, usually during the last 30 minutes of the appointed session.
3. Each student answers three questions on a worksheet:
   a. Which aspects of the course facilitate your learning?
   b. Which aspects of the course impede your learning?
   c. What can be done do overcome the learning obstacles?
4. The students gather in small groups to collect and discuss their answers.
5. The consultant collects the answers from all the groups and makes sure that everybody is clear about the meaning of each statement.
6. The consultant collects votes on the students' answers and notes the number of students who agree to the respective statement.
7. The consultant edits the results and sends a short written report to the teacher. This report usually contains only those statements that obtained a majority of votes during the classroom visit.
8. The teacher and the consultant meet for discussing the TAP results.

3. Flipped Classroom

Flipped Classroom (FC) is a teaching and learning paradigm that has its roots in several developments. One is the general tendency for teachers to focus more strongly on the students' actual learning processes than on the content and knowledge that is to be delivered by the lecturer. Barr and Tagg (1995) coined the corresponding slogan "Shift from Teaching to Learning" (even if they discussed this shift mainly from an organizational and economic perspective). A similar motto is King's (1993) "From Sage on the Stage to Guide on the Side", which prescribed a more intensive use of interactive deep-learning activities. Another root of the FC paradigm is the technical development, especially concerning web-based video technologies. This allowed teachers to use the video medium more and more for documenting and accompanying their classes and lectures by having them recorded and these recordings distributed over the internet, making it easier to reach their students as opposed to being restricted to video tapes or DVDs that have to be distributed physically and with much more effort. Basically, flipping or "inverting the classroom means that events that have traditionally taken inside the classroom now take place outside the classroom" (Lage, Platt, & Treglia, 2000, p. 32). Some authors go a little further an include the use of computer-based instruction as a defining aspect of FC (Bishop & Verleger, 2013, p. 5).

4. Flipped Classroom Evaluation in Practice

As the concept of Flipped Classroom is rather new, the success of FC lectures is still questionable. While most authors describe mainly positive impacts of the concept (Cui Tan, Wei-Gang Yue, & Yu Fu, 2017) negative estimations of the concept can also be found that assert no significant differences regarding learning outcomes when compared to traditional lectures (Gillette et al., 2018). To support their findings, researchers use different metrics to assess and evaluate the FC-concepts. But standards in FC evaluation are still rare (Stöhr & Adawi, 2018). A comparable overview is still missing and researchers. Researchers call for more standardized evaluation methods to assess the FC (O'Flaherty & Phillips, 2015). Our research contributes to closing the research gap about "How or why does the flipped classroom work, for whom, and in what circumstances?" (Stöhr & Adawi, 2018). This overview may help to cluster the great variety of FC assessment approaches and to lead to a better understanding of the purpose and implications.

To establish an evaluation for an FC concept, the *aim* must be defined. Formative evaluations monitor the students'student's learning to provide ongoing feedback for the instructors to improve their teaching and for students to improve their learning (Baker, 2014). To compare the FC to (mostly) traditional lecture designs (Hibbard, Sung, & Wells, 2016), often the summative assessment is used. Some studies combine both, measuring, e.g. the learning outcomes and perceptions about the lectures (Baker, 2014; Vogelsang & Hoppe, 2018). Most evaluations focus at the students (Lundin, Rensfeldt, Hillman, Lantz-Andersson, & Peterson, 2018). Evaluations measuring the lecturers' perceptions and advance are rare (Baker, 2014).

Evaluations often compare performance measured in mid- and endterms (Amresh, Carberry, & Femiani, 2013). A pre-term assessment is useful if later comparisions or estimations about the development are desired (Al-Zahrani, 2015). Furthermore, accompanying in-class assessments enable previous knowledge to be checked and quality to be assured (Mahoney, Zappe, Butler, & Velegol, 2015). Midterm assessments are a common technique to evaluate learning success (Demski, 2013). In-class and online-assessments, complement the flip model (Mahoney et al., 2015). Some authors combine both methods (Sun, Xie, & Anderman, 2018). The decision about *when* to evaluate defines the possibilities of analysis. For an adequatean adaquate evaluation design, it is also necessary to be sure *how* the evaluation should be conducted (Mahoney et al., 2015). Qualitative data is often used to assess self-reported perceptions about the class desing while quantitative measures are often used for acceptance (Vogelsang & Hoppe, 2018) or efficacy (Sun et al., 2018) evaluations. They are often built on existing scales that measure perceptions, subjective experiences and satisfaction (Foldnes, 2016). There is a wide bandwidth in evaluations of *what* is assessed. Attitudes towards the FC like enjoyment, self-confidence and perceived value of the content (Foldnes, 2017) as well as the learning success (McLean, Attardi, Faden, & Goldszmidt, 2016) and the effectiveness (Sun et al., 2018) can be evaluated. These last results mainly aim

at the exam grades. Further positive statements regarding the problem-solving abilities of students exist (Gillette et al., 2018). Despite the measurable learning success, Foldnes (2017) proves that the increase of group interaction positively influences the learning outcomes. Due to the variety of possible and existing FC evaluations, there is a clear lack of applicable and comparable standardized methods to evaluate FC (Vogelsang & Hoppe, 2018). FC is rich in both ways: knowledge mediation and interaction. Therefore a "rich" and qualitative approach can be useful for evaluation purposes. Many evaluation tools are complicated, time-consuming and are often based on premises that do not necessarily apply to FC. Following the call for standard evaluation method, we will in the following present the TAP as an evaluation method for FC scenarios.

5. TAP for a Flipped Classroom Scenario: A Case Study

The FC learning concept is applied in a learning group of about 40 students of the study programs "Information Systems" and "Business Administration". The subject of the course is "business process management". The concept consists of three different pillars: online-tutorials, face-to-face reading seminars and guest lectures from practitioners. Fundamental learning contents are made available to the students via video tutorials. The video tutorials replace the teacher-centered lecture format (Herreid & Schiller, 2013). Sets of slides which contain fundamental knowledge content are verbally described and narratively complemented by carefully chosen examples and applications. For the exchange of material, the digital learning management system Stud.IP is used. The second component of the FC environment is a so-called "reading seminar". The students prepare different texts at home and prepare them for the in-class time where the texts are discussed. A professor moderates the discussion. Finally, guest lectures by professionals working in the industry and consulting form the third component of the course concept. This additional information completes the knowledge of the field by illustrative application examples in addition to the fundamentally structured video tutorials and the in-depth reading seminar.

6. Results TAP

The TAP was conducted at the end of the term in the absence of the teacher and according to the proceedings described in section 2. A total of 17 students participated in the TAP and generated six positive statements, five negative statements and one suggestion for improvement (Table 2 summarizes the results). The most important positive statements relate to aspects not specific to FC. Still, a solid majority of student value the flexibility offered by the online videos provided within the FC approach. The most striking negative statement, as well as the corresponding suggestion for improvement, are about a central aspect of FC,

namely the way the online videos are incorporated into the overall instructional design of the course.

Table 1: Results of the TAP.

a) Positive statements	N	%
Availability of trials and old exams	16	94 %
Lecture presentation files »slides«	15	88 %
Online videos (repetitive viewing possible)	14	82 %
Free time management	13	76 %
Discussion of the papers	8	47 %
PossibilityAbility to ask questionsend questions via e-mailemail	4	24 %
b) Negative statements	**N**	**%**
Little incentive to watch videos regularly and promptly (risk of »bulimia learning«)	14	82 %
Contents of the papers are not always relevant to the exam	10	59 %
Video volume is very low	7	41 %
Rare interaction of the course professor	6	35 %
Video style »read out« fast; the videos provide no »lecture feeling«)	3	18 %
c) Suggestion for improvement	**N**	**%**
Meetings in between the videos (e. g. to work on assignments, concrete tasks in the sense of a tutorial)	17	100%

7. Discussion and Outlook

The results of the TAP underline the fit of TAP for FC courses. TAP, more systematically than standard evaluation questionnaires, aims at formative evaluation *(aim)*, as TAP reflects the form of the lecture. By using standardized questions, both target groups, students and lecturers, are prompted to reflect their behavior and improve in the future *(who)*. In our case, we conducted the TAP at the end of the term *(when)*. For future evaluations, we would strongly favor a midterm evaluation. This allows the lecturer to react to the results and to adapt the teaching behavior, which can be a positive signal regarding the needs of students and may lead to an improved and more trustful teaching situation. FC, as well as TAP, allows teachers to learn about their students, their perspectives, learning processes, etc. We regard this mutual influence as a major asset of this evaluation, as students are forced to reflect upon

their learning behavior, outcomes, and perceptions *(what)*, which is much less pronounced in the case of standardized summative evaluation questionnaires. FC as well as TAP focus on the learning process. This is why this kind of evaluation fits the situation very well. FC prepares students for active engagement in discussion and reflection, as prescribed by TAP. The students feel responsible for their learning process as the FC demands more self-regulation. As TAP is more a qualitative evaluation *(how)*, there is no standard scale for interpretation available *(scale)*. Using TAP consequently may nevertheless lead to a pool of results that allow for a systematic classification and interpretation. Future research may contribute to a common collection of TAP results aiming at a common pool of results and the measures taken afterwards. Possible research may also examine combinations of standard evaluations and TAP for FC, allowing for a comparison between these two evaluation approaches. Furthermore, we would encourage researchers to compare the TAP findings of FC classes with those of a standard lecture control group. Despite the merits of our research, the process suffers from some limitations. Due to the shortness of the research paper, we were only able to present the findings using one case. This is why the example cannot be free of influences due to the sample and special situation. The expansion of our research in the future will counteract this limitation.

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Development of business students' attitudes towards entrepreneurship between 2017–2018

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Abstract

This article presents the results of the development of the students' entrepreneurial attitudes between the first and third semester. According to the findings, the attitudes towards entrepreneurship were quite positive in the beginning of the studies, and it seems that they remained at the same level during one year. Based on the findings, as a practical implication there is a need for monitoring pedagogical approaches and methods of the programme to make sure that they support enough the development of entrepreneurial attitudes. The entire development of entrepreneurial competences will be revealed by the next annual studies.

Keywords: Attitudes; Entrepreneurship; Business students; Perceptions.

1. Introduction

At the university level, the main objective of entrepreneurship education is to increase students' awareness and to highlight the entrepreneurial path as a viable career option (Fayolle & Gailly 2015, 77). According to a study that examined the impact of different pedagogical approaches on the development of personal attributes and perveived skills related to entrepreneurship, it was noticed that an active-based entrepreneurship pedagogy (i.e. a mix of project-based learning and traditional lectures) seemed to have an influence attitudes, and therefore, instead of a direct effect, to have only an indirect effect on the development of entrepreneurial intentions (Varamäki et al. 2015, 574).

In the autumn 2017, a new curriculum (OPS2017) was launched in the business department of a Finnish university of applied sciences. Besides developing business skills, the curriculum of business studies aims at supporting the development of entrepreneurial competences of students, and promoting the students' entrepreneurial behaviour during the studies. In addition, the new curriculum aims at supporting better the development of competences for setting up and running one's own company. In order to make the development of students' entrepreneurial competences feasible, these competences are examined by a follow-up study. It consists of three annual sub-studies related to entrepreneurial attitudes, generic entrepreneurial competences, and business-related entrepreneurial competences during the degree studies.

This article introduces the results of the development of the business students' attitudes towards entrepreneurship between the first and third semester. A survey including 27 variables of four main themes: Entrepreneurial characteristics and behavior, Interest in one's own enterprise, Entrepreneurial motives, and Barriers of entrepreneurship was conducted in September 2017 and then repeated in September 2018. The findings of these two surveyes create a starting point for examining the impact of the entire education on the attitudes.

2. Attitudes towards entrepreneurship

In general, an attitude represents an evaluation of a psychological object. Further, one's own belief associates the object with a certain attribute, and the person's overall attitude towards an object is determined by the subjective values of the object's attributes in interaction with the strength of the associations. Only beliefs that are readily accessible in memory influence attitudes at any given moment. (Ajzen 2001) Thus, an attitude is a mentally prepared state for any known subject, and a subjective consciousness that is affected by the environment. (Chen & Lai 2010, 3).

The basic intention-based process model demonstrates the role of attitudes in an individual's behaviour. It is argued that attitudes towards the behaviour, subjective norms, and perceptions of behavioural control affect one's own intentions. In addition, according to the theory of planned behaviour, people act in accordance with their intentions and perceptions of their control over the behaviour. (Ajzen 2001; Krueger & Carsrud 1993). For example, starting a business is intentional and can best be predicted by intentions. Starting a business cannot be predicted by attitudes, beliefs, personalities or demographics. However, intentions are best predicted by certain attitudes. (Ajzen 2001; Krueger & Carsrud 1993)

According to the theory of planned behavior, a positive attitude towards an entrepreneurial activity should contribute to forming entrepreneurial intentions, and past empirical studies have shown that the link between the attitude towards entrepreneurship and entrepreneurial intention is significant (Nowinski & Haddoud 2019, 184). Earlier studies indicated that changes in attitudes had a significant and positive impact on the development of entrepreneurial intentions (Varamäki et al. 2015, 575).

Further, attitudes, perceptions, and intentions towards entrepreneurship may vary over time (Fayolle & Gailly 2015, 78). According to earlier studies, entrepreneurial attitudes can become more negative during the studies in higher education, when the students' general awareness of entrepreneurship is increased (Pihkala 2008), and when the students will learn more entrepreneurial competences in higher education (Kakkonen 2012a; 2012b).

3. Implementation of the study

This study focused on a student group in Finland, and it was conducted in the beginning of the first semester (September 2017) and repeated in the beginning of the third semester (September 2018). An invitation and a link for the Webropol questionnaire was sent by email to the students who studied on a full-time basis on the campus (N = 65). In 2017 there were 61 respondents, and in 2018 there were 60 respondents.

The questionnaire was created based on existing theory of entrepreneurial behaviour and characteristics (eg. Gibb 2005) and it was used in a sub-study of a PhD (Kakkonen 2012a). The questionnaire included 27 statements related to four main themes: Entrepreneurial characteristics and behavior (9 variables), Interest in one's own enterprise (4 variables), Entrepreneurial motives (6 variables), and Barriers of entrepreneurship (8 variables). It is worth mentioning that the statements were not introduced under any themes in the questionnaire. They were displayed in rows without any information on the main themes. In addition to 27 statements as variables (alternatives for describing how well the statements corresponded with their own opinions: 1 = not at all   2 = not well   3 = fairly well   4 = well   5 = very well), the students were asked to give background information on their gender, and academic year as a control variable.

The data analysis was made as follows. First, the frequencies, means and standard deviations were examined by each variable, and then the means of the variables were combined as the combined variables according to the four themes introduced above. Finally, the findings were compared between the years 2017 and 2018.

4. Findings

The results of the two annual studies are presented by comparing the means of the variables (statements), and the means of the combined variables of each year. In 2017, there were 61 respondents of which 34 were male students and 26 female students (one student did not inform the gender). In 2018, there were 60 respondents of which 27 were male students and 28 were female students (5 students did not inform their gender).

4.1. Entrepreneurial characteristics and behaviour

In both years, the lowest mean of the statements of the theme Entrepreneurial characteristics and behavior related to the statement "The entrepreneurial risk is not for me" and the highest mean related to the statement "An entrepreneur can affect his success with his own actions". The mean of all the means of this theme (the combined variable) was 3.61 in 2017 and 3.57 in 2018. Table 1 introduces the means of the statements of this theme.

Table 1. Entrepreneurial characteristics and behaviour

Statements	2017 Mean	2017 St. Dev.	2018 Mean	2018 St. Dev.
The entrepreneurial risk is not for me	2.9	1.0	2.9	1.0
I like to work in changing circumstances	3.6	0.8	3.7	0.8
An entrepreneur can affect his success with his own actions	4.5	0.6	4.4	0.7
I cannot tolerate financial uncertainty	3.1	1.2	3.1	1.1
As an entrepreneur I have a chance to succeed	4.0	0.8	3.8	0.9
In my work I want to advance resolutely towards the goals I have set	4.1	0.8	4.1	0.8
If you work hard, you can make it as an entrepreneur, too	3.9	0,9	3.8	0.9
I want to work in a familiar and safe environment	3.2	1.0	3.2	0.9
Entrepreneurs are usually doing quite well financially	3.2	1.0	3.1	0.8

4.2. Interest in one's own enterprise

There were six statements about the interest in one's own entreprise. The statement "Entrepreneurship just does not interest me" had the lowest mean and the statement "As an entrepreneur I can take responsibility for my work" received the highest mean (4.3) of all the statements. The mean of all the means of the statements of this theme was 3.58 in 2017 and 3.50 in 2018. Table 2 presents the means of all the statements of this theme.

Table 2. Interest in one's own enterprise

Statements	2017 Mean	2017 St.Dev.	2018 Mean	2018 St. Dev.
An entrepreneur holds an esteemed position in the society	3.7	0.9	3.5	0.8
Entrepreneurship is interesting and challenging	3.6	1.0	3.7	0.9
I would like to utilize my education in my own enterprise	3.5	1.1	3.4	1.0
Entrepreneurship just does not interest me	2.9	1.4	2.7	1.3
As an entrepreneur I can take responsibility for my work	4.3	0.7	4.3	0.7
I would become an entrepreneur, if a suitable opportunity appeared	3.5	1.2	3.4	1.3

4.3. Entrepreneurial motives

The questionnaire included four statements about entrepreneurial motives. The statement "As an entrepreneur the quality of life is better than if I worked in a paid job" scored the lowest mean and the statement "An entrepreneur has the chance to be independent. his/her own master" scored the highest mean of all the statements. The mean of all the means of the statements of this theme was 3.65 and 3.58 in 2018. Table 3 presents the means of all the statements in 2017 and 2018.

Table 3. Entrepreneurial motives

Statements	2017 Mean	2017 St.Dev.	2018 Mean	2018 St.Dev.
An entrepreneur has the chance to be independent, his/her own master	4.4	0.6	4.2	0.8
My income level is better as an entrepreneur than in paid work	3.1	1.0	3.2	0.9
As an entrepreneur the quality of life is better than if I would work in a paid job	2.8	0.9	2.6	1.0
As an entrepreneur I can make independent decisions	4.3	0.6	4.3	0.7

4.4. Barriers of entrepreneurship

There were eight statements about barriers of entrepreneurship. The statement "My education does not support becoming an entrepreneur" got the lowest mean (1.8) and the statement "It is no use becoming an entrepreneur without practical experience" got the highest result (3.4) of all the statements. The mean of all the statements of the theme was 2.66 in 2017 and 2.54 in 2018. Table 4 shows all the means of the theme.

Table 4. Barriers of entrepreneurship

Statements	2017 Mean	2017 St.Dev.	2018 Mean	2018 St.Dev.
It is no use becoming an entrepreneur without practical experience	3.4	1.1	3.1	1.1
You cannot educate yourself for entrepreneurship; it is a native talent or a trait learned at home	2.1	0.9	2.1	1.1
Entrepreneurship takes all of the time, and there is not enough time left for the family or my own hobbies	3.2	0.9	3.0	1.0
As an entrepreneur I cannot develop myself enough	2.2	0.9	2.2	0.9
My education does not support becoming an entrepreneur	1.8	1.0	1.9	1.0
I do not master the skills required in business	3.0	1.0	2.7	1.1
I do not want to be responsible for the enterprise and its employees	2.7	1.2	2.5	1.0
An entrepreneur's life is nothing but toil	2.9	1.0	2.8	1.0

5. Summary and conclusions

This study aimed at finding out the development of business students' attitudes towards entrepreneurship between 2017 and 2018. The study was conducted in the beginning of the first semester (September 2017) and in the beginning of the third semester. The questionnaire consisted of 27 statements as the variables related to four main themes. Table 5 sums up the highest and the lowest means of the statements by each statement. In addition, it shows the means of the means by each main theme.

<div align="center">

Table 5. Summary of the means by the main themes

</div>

Statements	2017 Mean	2018 Mean	2017 Highest mean	2018 Highest mean	2017 Lowest mean	2018 Lowest mean
1. Entrepreneurial characteristics and behavior	3.61	3.57				
•An entrepreneur can affect his success with his own actions			4.5	4.4		
•The entrepreneurial risk is not for me					2.9	2.9
2. Interest in one's own enterprise	3.58	3.50				
•As an entrepreneur I can take responsibility for my work			4.3	4.3		
•Entrepreneurship just does not interest me					2.9	2.7
3. Entrepreneurial motives	3.65	3.58				
•An entrepreneur has the chance to be independent, his/her own master			4.4	4.4		
•As an entrepreneur the quality of life is better than if I would work in a paid job					2.8	2.8
4. Barriers of entrepreneurship	2.66	2.54				
•It is no use becoming an entrepreneur without practical experience			3.4	3.1		
•My education does not support becoming an entrepreneur					1.8	1.9

The findings of this study indicated that the attitudes towards entrepreneurship remained almost at the same level between the first and third semester of the degree studies. In addition, there were very weak indicators related to the findings that the attitudes towards entrepreneurship could even decline to some extent. The findings of the next annual study will reveal the trend of the development in September 2019.

Further, besides individuals' own abilities, skills and evaluations of probability of a failure, several studies indicate also how their shift to entrepreneurial actions is consistent with the culture dominating in their society (Bogatyreva et al. 2019, 310). Therefore, future studies could take into account the current entrepeneurship climate in Finland (eg. push and pull factors of rentrepreneurship) as well as other cultural aspects related to the Finnish entrepreneurial society.

All in all, since the impact of the entrepreneurship education is connected to its pedagogical approaches and implementation (Fayolle & Gailly 2015, 77), there is a need for monitoring the pedagogical methods of the programme during the studies. Therefore, a practical implication for the degree program is to assess that the content and pedagogical approaches support and promote the development of the attitudes towards entrepreneurship. The final results of the competences will be reveled by the next annual studies, and thus the impact of the education will be shown then.

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Competence Assessment and Competence Reflection in Software Engineering Education

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Abstract

In the course of digitalization, software is becoming increasingly important and is characterized by growing complexity. Without software, the use of digital technologies would be impossible. The increasing complexity brings major challenges for teaching and learning of software engineering with it. The dynamic of change in software engineering leads to permanent learning requirements, which have to be fulfilled holistically. The fact that the development of software requires a high degree of interdisciplinary thinking and a systematic cooperation of different roles, results in the demand for the development of interdisciplinary competences and makes the continuous holistic competence development indispensable, since technical skills are absolutely necessary, but not sufficient.

A central issue in the course of the holistic competence development is to be able to recognize existing competences in order to use them for the personal biography and competence development. In this context, the process of reflection plays a decisive role as it can make implicit areas of competences aware.

This contribution outlines a qualitative research approach which focuses on the question of how the reflection process of students in software engineering can be stimulated and supported by the use of a learning process-oriented competence assessment system.

Keywords: Competence Assessment; Reflection; Competence Development.

1. Introduction

In the course of digitalization, software is becoming increasingly important and is characterized by growing complexity. Without software, the use of digital technologies would be impossible. Software engineering is a knowledge-intensive discipline characterized by rapid development cycles and a permanent change in knowledge content.

Until a few years ago the academic education in software engineering was characterized by the pure imparting of specialist knowledge. Although the job profiles in the practice of software engineering require specialist knowledge, it alone is not sufficient for the fulfillment of the entire range of tasks (Sedelmaier, 2015). Comprehensive skills and the ability to reflect on the individual competence profile are also necessary to meet the requirements of the occupational field and it is emphasized, that the development of a professional and personal identity presupposes the integration of new information's into the personal context of knowledge (Hilzensauer, 2008; Schreiber & Söll, 2014). For a number of years, teaching in software engineering is increasingly changing. There is a change of perspective that addresses the promotion of holistic competences in the sense of an appropriate combination of expertise and interdisciplinary competences (Sedelmaier, 2015). Next to the accentuation of the comprehensive competence development a central issue in this context represents the ability to recognize and name existing competences in order to be able to use these for the personal biography and the further competence development. This ability is a prerequisite for the planned and conscious design of the individual life and the creation of the individual learning (Seidel, 2010). In order to be able to evaluate the individual competence profile and to consciously apply what has been learned situatively in other contexts, conscious deliberations with the self are required (Atkins & Murphy, 1993; Gillen, 2006). This requires a reflection performance that cannot be assumed from the outset, but has to be promoted through differentiated didactical and methodical instruments.

Currently, there is no regular use of instruments that help students in software engineering to reflect on their own competences. Against the background of the stated significance of the holistic promotion of competences in software engineering and the importance of reflecting on the individual learning processes and competence domains, it is necessary to empirically investigate the research aspects addressed.

This contribution focuses on the question of how the reflection process of students in software engineering can be stimulated and supported by the use of a learning process-oriented competence assessment system. In order to approach this question, it is first necessary to set out the theoretical frame of reference before the research design is substantiated and initial results are presented.

2. Theoretical Framework

2.1. The orientation to the concept of competence

Against the background of social, technological and economic changes at all levels of human life and the change from an industrial society to a knowledge society, the concept of competence has been widely discussed within the national and international educational debate (Gillen, 2006). The restructuring of companies, which took place increasingly in the 1980s was associated with new forms of learning and organization and led to the demand for the entire spectrum of the professional, social and personal skills of the subjects. This resulted in an intensive discussion of competences, that play a key role in fulfilling the increased living and working conditions associated with these changes (Gillen, 2006). The demand for the full range of competence of subjects leads to the fact that the formal transmission of knowledge alone is not sufficient to meet the differentiated demands of our current society. Informal and non-formal acquired skills that cannot be proven in certificates therefore increase (Arnold & Rohs, 2014). This development is accompanied by a reassessment of learning, which focuses on all ways of knowledge acquisition and on all forms of learning and learning outcomes (Seidel, 2010). In the course of this development, methods for recording, assessing and documenting competences are given great importance (Kollewe, 2012). It should be mentioned that no consistent concept of competence exists. Different approaches of the concept of competence exist due to the respective theoretical tradition and the reference of the practice field (Preißer & Völzke, 2007). This contribution understands competences as resources that enable a subject to act adequate in different contexts and defines competences as a compound of trainable subjective action potentials with respective external conditions of action (Bender, 2009).

2.2. Self-directed competence development and the reflection of individual potentials

In today's knowledge society, knowledge content is rapidly becoming obsolete. This results in continuous learning requirements for individuals in all areas of life. Coping with the increased demands strongly depends on the self-directed development and reflection of individual potentials (Kollewe, 2012). It is emphasized that people no longer only learn in preparation, but are continuously confronted with new learning requirements, which demand constant competence development and competence reflection (Arnold & Rohs, 2014). In the course of the EU-wide discussion about self-directed lifelong learning the importance of reflection is increasing. Reflection is given great importance in order to be able to consciously apply and transfer what has been learned situationally in other contexts and to facilitate the integration of theoretical contents of study into the practice of the working environment (Hilzensauer, 2008). This understanding is conceptually justified, in particular through the work of John Dewey and Donald Schön, which have exposed the specific relationship between own experience, targeted reflection and communicative interaction for learning

(Dewey, 1910/1997; Schön, 1983). Dewey defines reflexive thinking as "[…] active, persistent, and careful consideration of any belief or belief in the light of the grounds that support it, and the future conclusion to which it is […]" (Dewey, 1910/1997, p. 6). Dewey assumes that thoughts build consecutively upon each other and new insights are gained on the basis of existing knowledge and related to previous experiences. Reflection takes place with two emphases. On the one hand as a deductive activity that focuses the recourse on already made experiences and existing knowledge. On the other hand as inductive activity, which leads to new insights and conclusions (Dewey, 1910/1997). Donald Schön's reflection concept builds on Dewey's theory. Schön distinguishes two differentiated modes of reflection, namely, "Knowing-in-action" and "Reflection-in-action". "Knowing-in-action" is knowledge that manifests itself in action. Schön describes this form of reflection as reflecting on the incident and as action-inherent. Reflection-in-action is also action-inherent and refers to the ability to react spontaneously and intuitively to surprising turns in a situation based on previous experiences (Schön, 1983). For the investigation of the reflection process in relation to the individual competence profile in software engineering, the stated considerations of the understanding of reflection from a constructivist perspective is suitable, because from this perspective learning is an active construction process in which new domains of knowledge develop, based on previous experiences and in connection to existing knowledge domains (Arnold, 2012).

Against the background of the stated significance of reflexive processes in relation to one's own knowledge and individual competence domains, it becomes clear that the reflection of the individual competence profile therefore plays an important role, as it initiates the promotion of personality development and self-knowledge and contributes a reflected and self-organized acquaintances with individual decision making and action-taking.

2.3. Competence development and competence assessment

The emergence of new competences is directly related to the recognition of already existing competences. In addition to the qualifications acquired and certified in formal education processes, the focus has to be on comprehensive skills and competences acquired in informal and non-formal learning processes, as the holistic competence profile must be reflected in order to reposition and depict as a subject in the changing society (Seidel, 2010). One way of promoting the reflection process in connection to the individual competence profile represents the process of competence assessment. Competence assessment is a dynamic process in which skills are collected through differentiated reflections. In addition to formally acquired competences, the focus is also on those that were acquired in in- and non-formal areas. In the last decade, a multitude of instruments for competence assessment with a wide variety of possible applications and objectives has emerged (Kaufhold, 2006). These instruments can be differentiated against the background of their various characteristics and properties. The underlying concept of competence, the method of data collection and the target orientation

of the assessment can be used as a basis for differentiation. The observation of the concept of competence used by the differentiated procedures allows to draw conclusions about their quantitative or qualitative orientation. While quantitative methods of competence assessment focus on the external perspective and aim at the pure measurability of the competences and their characteristics, qualitative methods try to describe the inner perspective of the competence dispositions (Erpenbeck et al., 2017; Kollewe, 2012). Quantitative methods assume that competences can be accounted in objective terms by measuring them against externally established standards, which do not take the complexities of human coexistence into account. Qualitative methods, however, focus on the individuality of the subject. Since competences are always subject-bound, these methods do not assume that they can objectively measure competences, but rather aim at the description and assessment of competences resulting from methods such as narrative interviews and biographical methods (Erpenbeck et al., 2017).

3. Research Design

The importance of the competence-orientation in our modern society was carried out in the previous chapter and the consideration of the related work turned out how important the reflection process is in connection to a comprehensive competence development and the assessment of existing competences. In order to answer the question of how to stimulate and support the reflection process of students in software engineering by the use of a learning process oriented competence assessment system, the description of the research design is given in the following chapter. The aim of the study is to examine the contextual conditions of the reflection process with regard to the target group of students in software engineering as well as the peculiarities of these target groups in relation to the reflection process. To achieve this goal a survey conducted with students in software engineering in the first, third and seventh semesters was carried out. The survey form interview was selected as a form of qualitative interview, since the basic idea of this form according to Strübing is to create an almost everyday conversation situation during the interview so that the interviewed individuals are encouraged to present their perspectives and assessments (Strübing, 2013). In order to achieve the objectives of the study and to evaluate the interpretation patterns of the students in relation to the reflection process of their individual competence profile, this method of data collection has become particularly suitable. During the interview a non-standard guide with open questions was used. The guideline served as a guide during the survey, which should ensure that all important aspects of the research interest where focused. The chosen survey method required moderation of the interview, which did not aim at the merely querying of the pre-formulated questions, but maintained the flow of conversation and mapped the relevant structure of the interview. The following focuses were placed in the interview in order to evaluate the interpretation patterns of the students in relation to the

competence reflection process. They were asked for their subjective description of their study and their learning actions, the assessment of the necessary / individual competence profile in software engineering and for individual expectations of their further study / professional life. Due to the qualitative orientation of the stated research question, the research design was based on the classical, theory-generating survey method, the grounded theory (Strübing, 2013). This methodology was chosen since it is particularly suitable for the evaluation of interview data and allows a systematic interpretation.

4. Results and Outlook

The consideration of the collected data with regard to the awareness of the individual competence profile has revealed, that it is not yet fully developed, especially among young people. It turned out that students in the first semester, who have not yet had examinations in their field of study, do not dare to adequately assess their competences, since they have not yet received any "formal feedback" for their performance during their studies. This focus on the formal evaluation results of the examinations, which only test the expertise and its application, shows the lack of awareness for the differentiated forms of learning and ways of competence acquisition, which also lie outside the formal education sector. The development of this awareness strongly depends on the formation of the self- and concept-knowledge, since the self-image must be developed and knowledge about structures of the professional world in software engineering must be acquired, at the beginning of the study. In this regard it is important to notice, that competences are considered to be the result of differentiated learning and socialization processes and are acquired in the process, but cannot be taught. Similarly the development of competences is a process characterized by a biographical history in which complex causal relationships exist that demand the reflexive consideration of the individual living and working context of the learning subjects (Ratschinski, 2014). Furthermore, the analysis of the data has shown that the awareness of the importance of interdisciplinary skills is well-developed among students. Thus, students are already aware of the importance of interdisciplinary competences and state that those are important as software is developed in teams of individuals who need to interact with each other and various stakeholders. While software engineering education in the past mainly focused on training of technical and methodical competences (e.g. programming, development of software modules, etc.) in recent years it concentrates more on the promotion of interdisciplinary competences (Sedelmaier, 2015). An important aspect of this support is the education of students' awareness. In exercises where they meet customers or develop their own software systems as a team and have to adapt to their team members and customers, the awareness of the importance of a holistic competence profile is specifically trained.

In order to integrate a "reflected practice" into everyday academic life in software engineering training, subject-specific course development is necessary. This requires a deliberate solution

of certain role ideas and the encouragement of the self-learning and thinking of the students. Through deliberate stimulation and complementary cognitive access, the significance of the individual actions becomes more conscious and understandable through systematic analysis, theorization and classification into larger contexts. For this the students need to be made aware or even irritated, so that they recognize all kinds of learning. Based on the first results of the data analysis, the ProfilPASS as an already existing competence assessment tool is currently examined with regard to its suitability for the target group of students in software engineering. The ProfilPASS is a development-oriented competence assessment instrument that places the individual and its development at the center of the competence reflection. Since personal competences, abilities and knowledge are shown in coping with everyday situations and situational actions, the focus of the ProfilPASS procedure is on the reflection of the individual action and the derivation of subjective competences. The aim of using the ProfilPASS in software engineering education is to examine it with regard to its contribution to the promotion of the awareness of the individual competence profile. In the course of this investigation, supporting factors of the ProfilPASS are examined, which are considered to be profitable for students in software engineering in the process of competence assessment. The analysis results are then used as the foundation for the conception of a didactic design, which should support the students in recognizing and naming both their technical and their interdisciplinary competences. The students can use the results of this competence assessment as a basis for reflection with regard to their future life and work perspectives. On this basis, it is possible to draw important conclusions for the formation of the individual educational, occupational, and life biography.

Acknowledgment

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Dual-evaluation with formative peer-assessment by rubrics: A teaching experience in Business and Economics studies

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Abstract

This paper shows the implementation of a learning experience based on formative peer feedback. The experience consists in the grading of an individual assignment using a dual-evaluation with peer's assessments method using rubrics. We develop this experience in a variety of subjects corresponding to three different Bachelor's degrees related to Business and Economics and gather the student's reflections about how this learning experience has influenced the acquisition and development of a set of generic competencies. Overall, students value positively the experience. In general, they consider that the ability to evaluate and maintain the quality of work produced and the determination and perseverance in the tasks given and responsibilities taken are the competencies most developed with this learning experience. This opinion is pervasive across the different characteristics of the students. Considering the kind of task, the ability to identify, pose and resolve problems is the competency most developed for the students that solve a practical exercise.

Keywords: Formative assessment; Peer feedback; Generic competencies; Dual assessment; Rubrics.

1. Introduction

Learning methodologies must aim to develop student competencies at the same time knowledge is acquired. Martínez and Echevarría (2009) state that any kind of real convergence is not possible without major changes in pedagogical strategies. There is widespread acceptance that assessment needs to be changed to improve learning. The learning strategies must go hand in hand with an evolution in assessment systems. González and Wagenaar (2003) indicate that changes in teaching and learning approaches and objectives imply corresponding changes in assessment criteria and method. These modifications must not only take into consideration knowledge and content but abilities and generic competencies. The use of different evaluation parameters is, thus, widely recognized (De Miguel, 2009).

Implementation of on-going evaluation becomes a fundamental pillar in this process, in contrast to viewing assessment as the last part of the pedagogical process (Bloom et al., 1971). An ongoing learning approach highlights the role of formative evaluation which focuses on learning rather than marks/grades (Stiggins, 2002). Under this framework, lecturers must focus on facilitating formative evaluation and quality feedback to students, as opposed to becoming a mere knowledge transmission element. An effective and common way to articulate feedback on students work is the dual-evaluation method. This technique implies a double overview on students work before any mark is given. Several authors have confirmed the effectiveness of this type of feedback in experimental articles; among them are Covic and Jones (2008), Ellery (2008), Carless (2006), Gibbs and Simpson (2004) and Ashford-Rowe, Herrington and Brown (2014).

This article contributes to previous literature by developing a different design for experimental in-the-classroom assessment. The assessment material is based on practical tasks instead of lengthier assignments/essays. The students must work on their assignment on a given topic by putting together new concepts, analysis skills and drawing conclusions. When the first round of the task is completed, the student gets a mark as well as detailed feedback indicating mistakes/suggestions/comments on the work. They will also be given personalized orientation about how to improve their weak points. Dual-evaluation is then implemented by confronting students to the same task within a few days. Students dispose of a new opportunity to do the task but with more knowledge and skills to approach it.

Benefits associated to this double correction methodology in terms of learning can be offset by a main drawback: it increases dramatically the teacher's work load. In order to compensate this collateral effect, this study introduces another methodological contribution which adds on pedagogical advantages. The first correction will be conducted by peers from the same class who review their peers' work and conduct a pre-evaluation suggesting weak and strong points as well as possible improvements. A participative classroom where

students have shared responsibilities and proactive attitudes on their own work will increase their autonomy, learning capacity and self-control. Boud (1986) estimates that self-assessment and peer's evaluation can reduce teacher's work up to 30%. Moreover, student's self-assessment methods are as good as those involving the teacher –as long as some conditions are fulfilled- and also have positive effects on learning (Bretones, 2008).

Literature suggest that self-assessment works better using rubrics. Andrade (2000) define rubrics as a way to communicate expectations for an assignment, providing focused feedback on works in progress, and grading final products. Reddy and Andrade (2010) state that rubrics articulate the expectations for an assignment by listing the assessment criteria and by describing levels of quality in relation to each of these criteria. Rubrics tend to be quite informative for students, thereby helping them think, learn, and produce high quality work.

In contrast to other studies, our work aims to investigate the effects of this learning experience, i.e., dual-evaluation with peer's assessments (DEPA method), on the achievement and development of generic skills and abilities, that is, generic competencies achieved by students. For example, Topping (1998), Falchikov and Goldfinch (2000), Dochy et al. (1999) have focused on the reliability and effectiveness of peer-assessment, however, they do not study competencies achievement.

The analysis presented in this paper is the outcome of an innovative education project (IEP) developed in the Facultad de Ciencias Económicas y Empresariales (Universidad Complutense de Madrid). A total of 186 students receive the double-correction assessment using rubrics. The learning experience is conducted in 4 different subjects from three different Bachelor's degrees related to Economics and Business.

The article is structured as follows: Section 2 describes the learning experience and the DEPA method in practice; Section 3 shows the results, and Section 4 presents the main conclusions.

2. DEPA method in practice

The participants in the learning experience are 187 students enrolled in four different subjects corresponding to three different Bachelor's degrees (Bd): Microeconomics, 1-year Bd in Economics; Macroeconomics, 2-year Bd in Business Administration; Empirical Finance, 3th year Bd in Baking, Finance and Insurance; and Applied Econometrics, 4-year Bd in Economics (see Table 1). This variety of subjects, years and Bds enriches the analysis as there are huge differences between them subjects. This also permits us to design two different kind of homework assignment for student: practical exercises and empirical analyses.

In particular, for Macroeconomic I (MA) and Microeconomic I (MI), the assignment is a practical exercise in which students must answer with detail some questions using theoretical knowledge on the subject. For Applied Econometric (AE) and Empirical Finance (EF), the assignment is an empirical analysis in which students must analyze a set of real data to test several (economic or financial) hypothesis with econometric and statistical tools and make a formal report summarizing the most relevant results.

We are attentive to the importance of involving rubrics in formative feedback. The rubric is a useful assessment tool for peer-assessment by students that give graduations of quality and criteria that are easy to follow (Andrade, 2000, Reddy and Andrade, 2010). By scaffolding the criteria, rubrics not only allow students to grade easily peer assignments, they also permit them to better understand the requirements to accomplish their own assignment. For this learning experience, the lecturers design a bespoke rubric for each subject that has two essential features: evaluation criteria (i.e., the criteria that describe the the different dimensions that determine the quality of the assignment) and the rating scale to assess the performance for each criterion (i.e., the detailed explanation of students' skill, proficiency and standard in order to attain a particular level of achievement). For the rating scale we use a simple Liker-scale that appears in the columns of the rubric matrix.

We implement the learning action through the workshop activity of Moodle 2.6. that allow the collection, review, and peer assessment of students' assignments. Both the allocation of submissions and the rubric matrix are configured by the lecturer in the workshop settings. Reviewers were anonymous.

To launch this learning experience, the lecturers distribute a document with a detailed assignment description, with detailed information about deadlines to make and deliver the task, and the rubric to the student audience. They read and discuss this document in the class room, explaining each phase of the activity and the rubric to the students. They also explain how the final grade will not only depend on how students meet the assignment objectives, but also depend on the quality of the assessment that they make of their peers. In the final phase, the lecturer evaluate both the assignment quality and the performance of students in the peer-assessment activity and give a final grade.

3. Students' assessment of the learning experience

We gather the student reflection on the innovative learning experience through an anonymous, non-compulsory completion of a bespoke module survey in which students must assess to what extent the experience has contributed to improving their skills. According to the Tuning Project (González and Wagenaar, 2003), competency is defined as the set of knowledge and skills that the student is expected to master and understand after completing the learning process. The survey focuses on generic competencies (independent

of the subject and transferable between areas of knowledge). We follow the classification of the Tuning Project, which distinguishes three types of generic competencies: Instrumental competencies: cognitive, methodological, technological and linguistic abilities; Interpersonal competencies: individual capacities such as social skills (social interaction and cooperation); and Systemic competencies: skills and abilities related to global systems (combination of understanding, sensitivity and knowledge, for this it is necessary to previously acquire instrumental and interpersonal skills). The survey consisted of two parts: Firstly, it collects personal details that allow analyze if the student characteristics could influence their evaluation. Secondly, it collects the students' valuation on the degree of success of the learning experience in terms of achievement of generic competencies. We select 17 competencies from the Tuning Project and described by González and Wagenaar (2003): 6 instrumental; 7 systemic and 4 interpersonal competencies. The survey requires that students value the contribution of the experience to achieve these generic competencies by using Likert scale from 1 to 5, where 1 indicates minimum contribution and 5 maximum contribution.

The population consisted of 187 students (65 students in Microeconomics, 63 in Macroeconomics, 16 in Empirical Finance and 43 students in Applied Econometrics). The final sample consisted of 107 respondents (67 % of the population): 88% in Microeconomics, 32%in Macroeconomics, 69% in Empirical Finance and 86% Applied Econometrics. The percentages are a good representation of the population.

Table 1. Distribution of students in the sample

	EF	AE	MA	MI	Total
Male	8	27	10	22	67 (63%)
Female	2	10	10	18	40 (37%)
Repeater	-	1	5	9	15 (14%)
Not repeater	10	36	15	31	92 (86%)
Practical exercise	-	-	20	40	60 (56%)
Report	10	37	-	-	47 (44%)
Business Degree	10	-	-	40	50 (47%)
Economics Degree	-	37	20	-	57 (53%)
Total	10 (9%)	37 (35%)	20 (19%)	40 (37%)	107 (100%)

The sample consists of 107 students. The percentages are out of the full sample size. Business include students from Business Administration and Banking, Finance and Insurance.

Table 1 shows the percentages according to gender, subject, grade repetition (i.e. whether the students is a repeater in the subject), procedures designed, and degree. 63% of students were men and 37% women. 47% study Business Administration and Management or Banking, Finance and Insurance, and 53% Economic. The distribution of the subjects was: 9% Empirical Finance, 35% Applied Econometrics, 19% Macroeconomics and 37% Microeconomics. The procedure implied reports (44%) or practical exercises (56%). The students which repeat the grade were 14%.

A summary of the survey's results is shown in Table 2. Figures show the position that each competency has in the students' assessment about the utility of the learning experience to obtain and develop the competency. For each competency we show an order number from 1 to 17, based on the average rating assigned by the students.

Table 2. Ranking of the students' valuation on the success of the DEPA method to achieve generic competencies

	EF	AE	MA	MI	EAss	PAss	Fem	Male	Rep	NRep	Total
I. Instrumental Competencies											
Ability for abstract thinking, analysis and synthesis	5	12	9	10	11	12	14	9	4	12	11
Ability to plan and manage time	5	14	7	14	12	13	17	10	7	13	14
General basic knowledge	6	7	4	7	6	6	11	7	3	8	8
Knowledge and understanding of the subject area and understanding of the profession	6	9	11	12	8	14	13	11	9	11	13
Ability to communicate both orally and through the written word in first language	7	17	8	8	15	9	12	13	8	10	12
Ability to identify, pose and resolve problems	8	10	3	1	10	1	4	5	3	7	5
II. Interpersonal Competencies											
Ability to be critical and self-critical	1	5	5	11	3	10	9	4	7	6	7
Ability to work in a team	4	6	8	4	5	4	3	8	7	5	6
Interpersonal and interaction skills	10	11	10	15	13	15	10	15	10	15	15
Ability to act on the basis of ethical reasoning	12	15	1	9	16	8	8	14	1	14	10
III. Systemic Competencies											
Ability to apply knowledge in practical situations	2	3	12	3	2	7	5	3	5	4	4
Ability to undertake research at an appropriate level	3	13	13	16	9	17	15	16	12	17	16
Capacity to learn and stay up-to-date with learning	2	4	6	6	3	5	7	1	6	3	3
Ability to adapt to and act in new situations	5	8	9	9	7	11	6	12	11	9	9
Capacity to generate new ideas (creativity)	9	16	13	13	14	16	16	17	13	16	17
Ability to evaluate and maintain the quality of work produced	3	2	2	5	1	2	2	2	2	1	1
Determination and perseverance in the tasks given and responsibilities taken	11	1	11	2	4	3	1	6	7	2	2

Note: Figures show the position that each competency has in the students' assessment about the utility of the learning experience to obtain and develop the competency. For each competency we show an order number from 1 to 17, based on the average rating assigned by the students The competencies has been selected from the Tuning Project.

The figures in Table 2 are computed is as follows: First we average the ratings given by the students surveyed for each competency. This give us a classification of competencies from more to less punctuated. Thus, we assign the order number to each competency, where 1 corresponds to the one that has obtained a higher score, i.e., that one that has been more favored by the experience according to the average opinion of the students. In some cases there are ties in the valuation, which is why sometimes there are two or more competencies with the same order number.

The columns of Table 2 depict the results for the full sample of students and grouping them according to: (1) the subject; (2) the type of assignment carried out by the students (empirical work and report vs. practical exercises); (3) gender; and (4) if the student is repeating the grade or not. Results in columns 1 to 4 point to the systemic competencies as the most rated by the students. For EF students the most developed competence is the critical and self-critical ability, for EA, they value more the perseverance for achievement, for MA students is the ethical commitment and for MI, is the most successful competition is problem solving. According to the kind of assignment (columns 5 and 6) the critical and self-critical ability is very relevant in empirical work while solving problems is in practices, in line with the peculiarities of each type of exercise. We found some interesting differences between male and female students (columns 7 and 8). For females, the most successful competency is perseverance for achievement, while for males it is the capacity to learn and stay up-to-date with learning. Regarding repeating character of the student (columns 9 and 10), repeaters put in the first place the ethical commitment, whereas for non-repeaters is the ability to evaluate and maintain the quality of work produced. This competency is also the most developed with the learning experience when we analyze the full sample of students (column 11).

4. Conclusion

This paper shows the implementation of a learning experience consisting on a double-correction with peer's assessments. The aims are to increase the students' motivation, and to prepare them with a range of transferable skills, increasing the active and reactive participation in their learning process. We implement a DEPA method in a variety of subjects corresponding to studies on Business and Economics and gather the students' reflections about how this learning experience has influenced the acquisition and development of a set of generic competencies. Overall, students have valued the process of active and creative reflection that the DEPA method implies. It also has helped to improve communication between lecturers and students as it forces the lecturer to clarify the evaluation criteria, as it must clearly specify what students expect, what the learning objectives are exactly, and what is the level of requirement to facilitate mutual correction among students.

The results of the survey point to the suitability of the learning experience and the peer-assessment to improve the development of capabilities related to the concern for the quality of work produced and the determination and perseverance in the tasks given and responsibilities taken. This result is pervasive regardless the characteristics of the students and the subject in which the DEPA has been applied. Interestingly, the kind of task is important to explain the students' opinion, being the ability to identify, pose and resolve problems the competency most developed for the students that solve a practical exercises, and the ability to evaluate and maintain the quality of work produced for the students that perform an empirical analysis.

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Constructing a Career Mindset in First Year Students: The Building Blocks for Curriculum Design

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Abstract

Higher Education Institutions are under increasing pressure to produce competent and qualified graduates for the ever-changing labour market. However, this is no easy feat. This paper shows how a transformational change in Victoria University's teaching model created an opportunity for teachers to redesign first-year, employability-related curricula. The approach to this challenge focuses on the development of a career mindset in first year university students. Through the examination of two courses, one from the Bachelor of Arts and one from the Bachelor of Psychological Studies, this paper demonstrates a number of active learning and engagement strategies that can be incorporated into the classroom to empower first year students to develop a career mindset that can help them to develop and integrate employability related skills throughout their degrees and beyond.

Keywords: Employability; First Year; Block Model; Career Mindset; Student Engagement; Innovative Pedagogy.

1. Introduction

Stakeholders have long acknowledged that higher education institutions (HEIs) have an important responsibility to prepare tertiary students for the evolving workforce (Buchanan et al., 2009). However, due to the complex and dynamic nature of this task, and the difficulty that universities often have in adapting to change (Bullock, 2013), the success with which this role has been carried out remains questionable. The complexity of the task is a product, in part, of the different meanings associated with the term 'employability'. Firstly, universities face a pressure to ensure that graduates are equipped with the discipline based skills and competencies expected by external stakeholders such as professional accrediting bodies and prospective employers. Secondly, it is widely assumed that graduates ought also to be equipped with transferable skills and attributes that will allow them to succeed within the twenty-first century workplace (Lowden et al., 2011). Finally, universities recognize that individuals' development of employability skills is not confined to the period spent in higher education, but rather is a 'whole-of-life' endevaour (Solomonides, 2012).

The scope of this task presents employability-related curriculum designers in HEIs with a challenge: how to conceptualise and pursue the goals of employability teaching within what is often an already-crowded curriculum. First-year curriculum designers face a specific but very important component of this broader challenge: how should the 'employability issue' be introduced to students in their first year of study? This paper discusses an innovative response to this first-year curriculum-design challenge, one that centers on the goal of developing within students a strong career mindset.

This paper proceeds in two stages. Firstly, the paper briefly describes an institutional transformation that has occurred at Victoria University (VU), Melbourne. Understanding this transformation is important as it empowered staff to reimagine and redesign employability-related (and other) curricula, and it produced a new Block Model of Delivery (BMD) that set the context in which new curriculum ideas were applied. Secondly, the paper elaborates the approach to first-year employability teaching noted above. It defines the concept of 'career mindset' and demonstrates how this concept has shaped the design of two courses, each of which supports students as they build career mindsets relevant to their respective degrees.

2. Block Model Delivery in VU's First Year

The transformational change that has occurred over the past three years at VU represents a rare instance of an HEI acting in ways that significantly disrupt existing approaches to the design and delivery of teaching. At the heart of this transformation, which has generally been focused on the enhancement of the first year experience (FYE) of students, lies what is termed VU's BMD (Victoria University, 2017). Traditionally, VU (like many other HEIs) delivered full-time students four subjects in parallel across a 16-week semester. Alternatively, teaching

'on the block' involves students taking four courses, each four-weeks long, that are delivered sequentially across a 16-week semester. VU's ambitious goal in 2017 – to convert all first year courses to block mode prior to the start of teaching in 2018 – was a daunting task. What quickly became apparent was that this change would require the modification of most aspects of curriculum design, as well as many university systems and processes (McCluskey et al., 2018). However, with this disruption came a rare opportunity: to redesign curricula in order to better meet challenges, including those associated with employability-related teaching.

As well as providing an opportunity for substantive curriculum redesign, introduction of BMD also provided the context in which curriculum redesign took place. Perhaps the defining characteristic of BMD is that courses are taken by students one at a time. This provides an opportunity for educators to implement active and engaging activities, even if those activities stretch beyond 'normal' teaching times and classroom settings, as there are no competing demands from other courses. Focusing on one course at a time also enables students to reflect back on classroom experiences prior to moving on to their next course. Furthermore, due to the sequential nature of BMD, course designers are able not only to specify what objectives ought to be served by each course within a degree, but also to tailor the timing of the delivery of courses so that they best enable students to meet those objectives.

BMD was driven by research pertaining to the enhancement of the (FYE), particularly in an Australian context (Kraus, 2011; Nelson et al., 2014), and it consequently incorporates many of the features of what Kift (2009) has referred to as a 'transition pedagogy'. Transition pedagogy has been crafted with the context of widening participation in higher education and the needs of contemporary students firmly in mind. In particular, this encourages educators to adopt student-centered approaches to teaching, approaches that involve teachers working collaboratively with students in the processes of knowledge construction. In VU's BMD, small classes, each working with a single teacher, foster the formation of authentic learning communities. Within such communities, mutual trust empowers students to engage in meaningful collaboration with staff and with peers. It was with these characteristics in mind that the following instance of employability curriculum design took place.

3. Developing a Career Mindset in First Year Students

It has long been acknowledged that teaching employability related content in higher education is an onerous task (Wheelahan et al., 2012). Tailoring degrees to particular vocational outcomes is undermined by the complexity of employment sectors, by the rapid evolution of the employment market, and by increasing expectations that, in the future, individuals will hold multiple careers (Yu et al., 2013). Teaching for employability is particularly difficult, however, in the first year space. First year university students are a unique cohort as many of them are undergoing a transisitional period, not only from high

school to tertiary education but also from adolescence to adulthood (Urquhart & Pooley, 2007). Adding pressure, is the perception that during this period individuals should identify and begin pursuing clearly defined career pathways. It should not be surprising that first year students are often both anxious and uncertain about degree choice, their career goals, and the links between the two. Indeed, this is evidenced by the fact that students are more likely to transfer degrees and/or change majors during their first year of study (Beggs et al., 2008). Given the rapidly changing world of work, such uncertainty is entirely reasonable, but it still presents a challenge to first year employability educators.

The response at VU has been to centre first year employability teaching around the goal of developing in students a career mindset. Mindsets are beliefs that orient an individual's reactions and tendencies (Dweck, 2008). An individual's mindset plays a pivotal role in how they understand their experiences, cope with challenges, and perceive their future. More particularly, an individual's career mindset helps them to integrate knowledge and skills in order to become autonomous and purposeful participants in their own career development. Building such a mindset in first year empowers students to grow their employability skills throughout their studies, and even beyond the classroom.

Supporting students to build career mindsets requires consideration of the following. Firstly, career mindset teaching must be student centered; educators must take seriously the choices students have made in terms of degree, not necessarily as final career choices, but instead as expressions of students' existing knowledge regarding their skills and career goals. Secondly, engagement with discipline-specific content and skills is valuable, partly in its own right, but also because this can help students understand the context-specific nature of skills development. Thirdly, supporting students to reflect on their own values, skills and career aspirations, and on their engagement with discipline content and skills, is an essential step in building a career mindset. Overall then, in terms of process, curriculum design aiming to introduce employability to first year students should involve periods of introspection, of research and exploration and, finally, of reflection (Dressler, 2008). The small class sizes and intensive nature of BMD enhance make it possible to integrate this process into courses – such as the two considered below – in a student-centered manner.

3.1. Academic Discourse and Experience

The first course considered here, *Academic Discourse and Experience* (ABA1000), is a compulsory first-year course within VU's *Bachelor of Arts* (BA). Tasked with supporting the employability of BA students, the course faces the following two challenges. Firstly, VU BA students are uncertain and often anxious about the links between their course choice and potential employment outcomes. Secondly, this uncertainty can be exacerbated by the fact that the BA is widely recognised as a generalist rather than a vocational course. Because many students who enter the BA are unsure about where, in terms of employment, such a

course might take them, course designers at VU decided to locate ABA1000 at the very beginning of the first year of the degree. This offered course designers a unique opportunity to frame the BA, both as an academic endeavour and in terms of employability, and to build a narrative that draws together the two.

At the heart of this narrative is the notion of 'social values'; a phrase that is used to refer to a range of concepts (e.g. security and beauty) that are of interest to students, of academic importance, and of practical social and political relevance. The breadth of the range of values that are available for consideration, combined with the teacher-student engagement that small-class teaching offers, allows students to be supported as they investigate those values to which they are drawn. Students are then introduced to an array of academic literature that relates to their chosen conceptions of value. This approach helps students to transition into academic life; they are able to explore academic discourse surrounding concepts that are of importance to them.

Crucially, however, the course also asks students to explore the practical application of such concepts in real community settings. The course is built around two small-group field trips. It is through these field trips that students search for, gather and analyse evidence of investment in social value, and of the organisations that engage in such investment. By examining how their chosen values are expressed in the community, and the employers that invest in these values, students are able to construct an initial career mindset that can motivate and guide their studies within the BA. Put simply, students are able to link together the values that interest them, academic discourse regarding those values, and the employers that invest in those values in the local community. This process is designed not only to show students real employers that share their own values, but to help students to construct their own knowledge regarding the relevance to employability of their current and future studies within the BA.

3.2. Organisational Skills 1

Organisational Skills 1 (APP1015)*,* is an employability-focused course that is delivered to all first year psychology students. Many of those who enroll into a psychology degree do so with the mindset that they will be pursuing a career as a psychologist. What is often unkown to students as they begin their tertiary education is that this pathway is highly competitive and that following it to completion requires the gaining of postgraduate qualifications. Thus, the challenge in APP1015 is not so much to help students to build a career mindset, but instead to modify and broaden the career mindset that many of them bring with them to the course. Through the fostering of strong learning communities, facing what is normally a confronting reality is able to be reframed into a positive learning experience, one that empowers students to take control and plan for their own futures. Positioning this course towards the end of student's first year allows them to reflect on how the discipline based

content and skills they have already acquired will be useful to them in a broad range of career settings and, in turn, will allow them to evaluate their future experiences more critically.

Identifying what motivators underpin the desire of students to pursue their degree is fundamental for fostering a positive career mindset. Through class activities and discussions, students are exposed to a number of phenomena related to organisations in general. Encouraging students to evaluate various aspects of organisations is a useful and engaging first step to encouraging them to think about their own values in relation to employment. Once students have identified their values they then collaboratively, with other similarly minded students, investigate a range of careers and pathways that align with those beliefs. This reflective practice forms the basis for the classroom activities and assessments for the first third of the course.

Later in the course, students are encouraged to further explore their values and to link those values to a range of realistic and tangible career outcomes. Guest speakers, who have undergraduate psychology degrees but pursued pathways unrelated to clinical work, speak to students about graduate programs and careers in industry that utilize what are sometimes thought of as primarily discipline based skills. This enables students to begin building a network of individuals in their field, outside of university, and to appreciate the breadth of career pathways that are relevant to their studies. Furthermore, bridging the experiences students have in the classroom with real-world examples of what employers are looking for can provide students with purpose and context for their higher education experience. Students also engage in the analysis of job advertisements from a variety of vocational sectors; this helps them to construct connections between career pathways and the employability skills that are needed within them.

In the final stage of the course, students are supported as they work to integrate the knowledge that they have built, about themselves, about potential career pathways, and about the content and skills related ot their studies. Students are encouraged to evaluate the employability skills being sought in the advertisements they have reviewed, to reflect on the skills they have already begun developing (by evaluating their discipline based knowledge and experiences), and to identify methods for addressing any skills gaps that may have been noted. This process culminates in each student producing personalized online (LinkedIn) and offline career portfolios. Students leave the course with a tangible product that can support the ongoing construction of their career mindset, one that can be utilized in later courses, and in later periods of their professional lives.

4. Concluding Remarks

This paper describes an innovative approach to first-year employability teaching, one that focuses on building in students a strong career mindset. It then explains how the goal of developing a career mindset has shaped curriculum design in two courses.

The adoption of this approach to first-year employability teaching requires further attention. On the one hand, research is needed into student uptake of these ideas: evaluation of the mindsets with which students enter courses, and of the impact of subsequent career-mindset teaching, will enhance our understanding of the factors that impact on teaching quality in this area. On the other hand, research is also needed into vocational patterns and career destinations suited to distinct degrees so that career-mindset curricula can be authentic and targeted.

VU's BMD facilitated the restructure and design of the courses, and it also empowered educators to tailor the timing of delivery of these courses to best serve the needs of their respective cohorts. However, the underlying principles considered above can be applied to courses in various teaching modes. Furthermore, while this paper presents the design and strategies utilised in two courses, these methods can be adapted for incorporation into any degree or discipline. The general features of the approach adopted in both ABA1000 and APP1015 are clear. Building a career mindset requires supporting students through three stages of development. The first involves students engaging in introspection so that they understand the employability-related values, knowledge and skills which they have brought with them into their chosen course. The second requires educators to help students to explore discipline-relevant employment, preferably through the use of active and authentic teaching strategies. Again, this stage is of value even if some students later go on to shift majors, degrees, or even careers, because it helps students to develop an understanding of the contextual nature of employability-skills. A final, and vital stage, involves students engaging in reflection so that they can begin to integrate knowledge and skills within a coherent career mindset, thus setting them on a path of life-long-learning about employability.

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A comparison of on-curricular and off-curricular activities in enterprise education for postgraduate students

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Abstract

A comparison of the effectiveness of two educational activities are carried out; a standard on-curricular postgraduate unit and an off-curricular school activity. The taught area for both is the theme of enterprise and entrepreneurship. They share similar intended learning outcomes, equipping participants with the same skills, knowledge and tools to set up their own business start-up. Another similarity is the number of contact hours with the students, however the main difference is the span these two activities take place; over a full semester or over a week. A survey was designed to be used in post teaching sessions to evaluate the effectiveness and impact the activities had on the students in the area of enterprise and entrepreneurship. The results indicated that both activities had an impact on start-up intention and activity however, the cost of the enterprise school per head and the fact that the on-curricular activities provide a recognized qualification in case the business fails means that short intensive off-curricular activities are better suited for researchers with limited time and who are still open minded about career choices. Both activities serve their own purpose and value as they provide the desired interventions for supporting positive attitudes towards enterprise and entrepreneurship.

Keywords: Business start-up; Education; Entrepreneurship; Enterprise; Off-curricular; On-curricular.

1. Introduction

Enterprise and entrepreneurship education activities, both on- and off- curricular, for postgraduates are increasingly common throughout The University of Manchester (UoM) (Phillips, 2018). This includes both the Master of Enterprise (M.Ent.) unit Shaping Ideas for the Market (SIM) and the Enterprise School (ES) delivered by the Manchester Enterprise Centre (MEC). On-curricular activities the authors consider to be accredited units, optional or compulsory where entrepreneurship or enterprise education is a key component and entrepreneurial learning outcomes are assessed, e.g. the SIM unit. Off-curricular are activities which are voluntary and not credit bearing, e.g. the ES, Business Plan Competitions. The M.Ent. degree enables students to develop their entrepreneurial skills and start their own business or work for a company where enterprise and innovation are valued. SIM is one of the two core 15 credit units, two elective units are studied and a research project with a potential commercial application is carried out. It focuses on identification of opportunities and the development of business models. It includes various methods for obtaining market intelligence, analysis, identification, evaluate and refine valuable opportunities (UoM, 2019). The internal MEC records show that since 2001 more than 60 companies have been set up by the participants attending the SIM unit (unpublished data). The ES is an off-site activity (Phillips, 2017 & Phillips, 2010) where self-selecting postgraduates from any discipline attend for an intensive four days of entrepreneurship training, working in groups on an opportunity they identify in the local area to create economic or social value. It involves an introductory session followed by students putting into practice the skills learned and students complete a personal journal as a record of their learning (Phillips, 2008). Data suggests about 10% of students have started a business within a year of returning from the ES (Phillips, 2017).

1.1. Aim and Objectives

The two activities have the same aim in providing entrepreneurial education and providing skill sets for students setting up their businesses. They run in the same academic year, both are aimed at postgraduate students, and their main characteristics are presented in Table 1. The aim of this paper is to study the effectiveness of two types of academic activities in the area of enterprise that have on student attitude to setting up their business and on the skills that they have obtained attending this. The two types of deliveries although have the same contact hours, they have a different time span, the SIM unit is across 12 weeks (one semester) and the ES is across four days. The objectives are to: (i) provide a short description and analysis of what those activities offer, (ii) identify what is the perspective of the students attending them, and (iii) what the students gain from each activity.

2. Literature Review

The taught curriculum and off-curricular activities create the entire student experience (Fry *et al.,* 2015). The curriculum allows universities to differentiate themselves by expressing their individuality and focus on issues e.g. internationalisation, employability all of which are part of UoM agenda. While the university curriculum and its theoretical dimensions are well known in the academic world, the need to modify from traditional curriculum models to a more adaptive self-learning such as off-curricular has been suggested for a long time. Crompton (1987) mentions that the curriculum should be based on learning and not on knowledge, students should not be restricted by a curriculum that concentrates on the academic above the practical aspect. "Learning by Doing" is accepted as being a good method for encouraging entrepreneurial mindsets and is used on UoM enterprise courses (Sanchez-Romaguera & Phillips, 2018). The methods implemented by MEC for the two activities are in line with the Quality Assurance Agency and best practice, where the aim of the enterprise and entrepreneurship education is to provide interventions for supporting behaviours, and qualities that would provide students with the confidence to set up their own businesses and have a significant impact in successful careers that would add economic, social and cultural value to the UK (QAA, 2018). In the UK, a strong policy context exists for the development of enterprise and entrepreneurial education within Higher Education that is closely associated with employability enhancement (Artess *et al.*, 2017). Enterprise education that enhances employability requires a different approach to traditional learning and teaching pedagogies, which the two activities here strive to achieve. Off-curricular initiatives arising from the delivery of enterprise and entrepreneurialism include those that have the capacity to change institutional culture or practice (Artess *et al.*, 2017). Universities pursue to increase graduate employability business schools state the importance on 'developing the next generation of entrepreneurs' Bell (2016) which is also the motto of the M.Ent. There are no clear teaching methods on how to best encourage both entrepreneurialism and employability in students and this area is still a developing field. The literature on the effectiveness of entrepreneurship education is not conclusive, theories argue that entrepreneurship skills can be taught but entrepreneurship is partly an 'art' and cannot be taught. On the other hand, recent studies stated that entrepreneurial programmes have impacted on students' entrepreneurialism in an effective way (Bell, 2016). A meta-analysis study by Martin *et al.* (2013) found overall there was evidence to support that entrepreneurship training was effective. Effectiveness has been measured using a variety of methods including self-efficacy and start-up rates, in some cases followed over a considerable length of time (Matlay & Carey, 2007). With respect to extra-curricular activities, according to Kneale (2009), these are created to attract students who have an interest in enterprise but do not want to enrol to a whole module. The on-curricular lectures were well attended however attendance on not-for-credit or off-curricular activities

attendance was less consistent. It was found that the extra-circular activities were valuable 'signposts', but they could not offer the consistency of learning gained through the on-curricular modules. Students are unlikely to pursue a not-for-credit enterprise agenda unless they are very motivated. The extra-curricular activities, although undoubtedly enhancing the student experience, they are not financially viable on their own (Kneale, 2009).

3. Methodology

The methodology includes primary data collection across the two activities. A short survey, was carried out just after the completion of both activities, to identify if the enterprise activities had any effect in the participants linked to that aim and objectives. Table 1 shows the characteristics of the two activities.

Table 1. Characteristics of the two enterprise education activities.

Type of Activity	SIM (hrs)	ES (hrs)
Total in-class contact hours	33	21
Taught material from lecturers	20.5	6
Presentations/Mentoring from guest entrepreneurs/speakers	7.5	4
Workshop/tutorial/group working	2	6
Social activities	0	20 (optional)
Coursework (out of class hours activity)	117	0

4. Results and Discussion

The results of the surveys for the two enterprise education activities are shown in Tables 2-8.

Table 2. Question 1 Are you more likely to start a business having participated in ES or SIM?

	SIM no of responses	SIM response %	ES no of responses	ES response %
Yes	6	86	29	64.4
No	0	0	0	0
The same	1	14	16	35.6

Most students say they are more likely to start a business after attending this unit (there are participants in the course that already have started their own businesses). None seemed put off by the training as has sometimes been found elsewhere.

Table 3. Question 2 What are your career aspirations?

	SIM no of responses	SIM response %	ES no of responses	ES response %
Work in Industry	1	14	16	36
Technology Transfer	0	0	11	24.3
Academic position	0	0	8	18
Start Own Business	6	86	6	13
Consultancy	0	0	3	6.7
Not for profit	0	0	1	2

All students but one are more likely to start their own business after attending SIM (there are students that work already part time in industry). For ES, the participants had a broader range of career aspirations despite the self-selecting nature of the course.

Table 4. Question 3 What would be the reason for you starting a business? (two options)

	SIM no of responses	SIM response %	ES no of responses	ES response %
To improve society	0	0	22	97.8
To be better off financially	4	57	20	88.89
For the excitement	2	29	16	71.1
To be own boss	4	57	14	62.2
To create own job	2	29	4	17.78
Raise funds for research	0	0	2	8.89
Status	0	0	1	4.4
Create a spin-out company	0	0	1	4.4
Other	2	29	2	8.89

The main motives for the SIM students starting their own business is to be better off financially and to be their own bosses. However, for ES, improving society was rated highest which links with the anecdotal view that many of the students attending had an interest in social entrepreneurship regardless of their background.

Table 5. Question 4 What factors would encourage you to start a business? (two options)

	SIM no of responses	SIM response %	ES no of responses	ES response %
If they could see how it would benefit society	3	43	22	97.8
More training	0	0	19	84.4
If they spotted an opportunity	4	57	18	80
If they saw more examples from their own area	0	0	11	48.89
If it increased chance of getting research grants	1	25	5	22.22
If they had funding	3	43	1	4.4
Other	2	29	9	39.96

For ES, they seemed to be encouraged by seeing how their idea could benefit society, whilst those on SIM suggested spotting an opportunity might be the most encouraging factor. Those on SIM felt that no more training was required, although this was rated highly by ES participants.

Table 6. Question 5 What do you feel are the barriers to starting a business? (two options)*

*selected answers presented	SIM no of responses	SIM response %	ES no of responses	ES response %
Lack of Finance	5	71	19	84.4
Lack of Time	2	29	13	57.8
Risky	3	43	6	71.1

This question had the most diverse answers. The most popular answer was lack of finance, it is risky as most popular. Other answers were lack of time, support and little commercial application.

Table 7. Question 6 When would you ideally start a business?

	SIM no of responses	SIM response %	ES no of responses	ES response %
Start a business after gaining industry experience	2	29	21	46.7
Start a business as soon as you leave university	4	57	11	24.4
Create an academic spin out company while in an academic position	0	0	7	15.6
Be an intrapreneur in a larger organisation	1	14	6	13.3

More than half of the SIM cohort stated they would start a business just after finishing their masters programme. A third of the cohort stated they would after gaining industry experience. For ES, most seemed to want to work to gain experience before starting a business or those wanting to create a spin-out venture which would need the respondent to be in a secure academic position.

5. Conclusion

There were some notable similarities and differences between the students on SIM and ES. Students who chose to do the ES were more broad minded about career options than those doing SIM, who almost all were intent on starting a business and straight after graduating. Of those from ES that wanted to start a business, a number preferred to work in industry first. Also, those from ES wanted to use their entrepreneurial skills to improve society whist those on SIM were motivated by being their own boss and for financial reasons. Both ES and SIM agreed that finance was the biggest barrier to start-up. Overall, it seems that the objectives of encouraging student start-up are achieved by both SIM and ES although the motivations for each group are slightly different. However, an important consideration is that for the SIM a key benefit is that students who do not ultimately start a business have a masters level degree where they have demonstrated a link between their subject area and the commercial world which has been shown to be very attractive to potential employers. It is therefore important that the SIM unit is assessable in a conventional way for a credit bearing unit. For future work, it would be useful to carry out longitudinal studies of those that have participated in these different activities and ascertain whether the students are using these skills if they enter employment. We suggest that the cost of the enterprise

school per head and the fact that the on-curricular activities provide a recognized qualification in case the business failing means that short intensive off-curricular activities are better suited for researchers with limited time and who are still open minded about career choices. Since the off-curricular activities are funded by grants whilst SIM is funded by more stable students fees and existing infrastructure it is impractical to scale up ES beyond the keenest students each year. This is in agreement with Kneale (2009), however, both activities serve their own purpose and have their own value as they provide the desired interventions for supporting positive attitudes towards enterprise and entrepreneurship.

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Added value of post-secondary education in Estonia

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Abstract

Education is seen in the human capital literature as one of the determining factors for labour market outcomes (Blázquez et al., 2018), measured through multiple variables. The aim of the current study is to examine the change in the earnings of graduates from Estonian post-secondary education institutions. This is achieved by comparing graduates who had studied from 2013 to 2016 in four fields: engineering, information technology, economics and natural sciences. To assess the change in pre- and post-entry earnings difference-in-differences regression was used. The results indicate there are differences between disciplines in terms of added value. In economics gender differences have the smallest and entrepreneurial activities the largest impact for the change in earnings. The study contributes to our understanding of added value of post-secondary education by combining educational, tax and social data, and analysing the change in graduates' earnings pre- and post-entry.

Keywords: Earnings; Estonia; Labour market success; Post-secondary education; Value added.

1. Introduction

Education is seen in the human capital literature as one of the determining factors for labour market outcomes (Blázquez et al., 2018). In order to analyse and predict the post-secondary education (PSE) graduates' success in the labour market a combination of data sources has been used, including self-reported data, tax data and educational data. Graduates' earnings are a measure of the added value of education (Cunha & Miller, 2014), utilised for assessing the quality of education (Milla et al., 2016).

Previous studies have focused mainly on the comparison of the earnings of the graduates' groups. Thus, it has been found that the earnings of graduates from engineering, mathematics and computer science, and business dominate over other fields (Finnie, 2016). In addition, women's earnings tend to be lower across all levels of educational attainment (Behr & Theune, 2016; Bredtmann & Otten, 2014), related to gender differences in different sectors and the types of occupation (OECD, 2018).

The primary aim of the current study is to examine the change in earnings of graduates from Estonian PSE institutions. The additional aims were to build a platform for further research into graduates' earnings and demonstrate the feasibility of linking educational, tax and social data. This was achieved by analysing the earnings of people who had studied from 2013 to 2016 in four fields: engineering, information technology, economics (with synthetic knowledge base) and natural sciences (with analytic knowledge base). Difference-in-differences regression was used to assess change in pre- and post-entry earnings.

The results indicate there are differences between areas in terms of added value of post-secondary education. In natural sciences studying while working leads to the largest decrease in earnings. In economics gender differences are the smallest as being male has the least significance for increased earnings, but entrepreneurial activity in the form of earning dividends has the largest. The study contributes to our understanding of added value of PSE by combining data from different sources, i.e. linking educational, tax and social benefits data, and analysing change in graduates' pre- and post-entry earnings.

The rest of the paper is structured as follows. The subsequent section provides an overview of previous studies addressing added value in PSE. Then the overview of research methodology is presented, followed by analysis results. The results are discussed and conclusions drawn in the final part of the paper.

2. Literature review

The human capital literature indicates the positive returns of education for the labour market experience (Blázquez et al., 2018), although a number of factors other than education also play a role in individuals' earnings. Graduates' earnings are a measure of the

added value of education (Cunha & Miller, 2014) or one of the numerous variables to develop a methodology for assessing the quality of education from post-secondary education institutions (Milla et al., 2016).

The tax linkage approach entails linking PSE (post-secondary education) institutions' administrative information to income tax data in order to track and analyse graduates' labour market outcomes. This approach is becoming a standard in the analysis of PSE graduates' earnings in the OECD, which was developed an initial tax linkage project that appeared in the Education at Glance in the fall of 2016 (Finnie et al., 2018).

Recently researchers from the University of Ottawa linked institutional records with income tax data to track the earnings of graduates from 14 colleges and universities in four provinces. The main findings that engineering, mathematics & computer science, and business graduates generally had higher incomes and greater earnings growth than others (Finnie, 2016). It has been also found that in many countries, earnings are systematically lower for women than men across all levels of educational attainment (Behr & Theune, 2016; Bredtmann & Otten, 2014). This may be related to gender differences in the sectors where they work and the types of occupation (OECD, 2018). The current study looks at the change in earnings pre-and post entry to PSE institutions, rather than analysing the total earning of different graduates' groups.

The economic sectors differ in terms of the dominating knowledge base leading to differences in the innovation process. Previous research has distinguished between analytic, synthetic and symbolic knowledge base (Asheim & Gertler, 2005; Asheim, 2007; Tödtling & Grillitsch, 2014), resulting in different knowledge sources, patterns of cooperation and innovation outcomes. The current study employs the divide between sectors with analytic and synthetic knowledge base by including natural sciences as an example of the former and engineering, information technology, economics representing the latter.

3. Methodology

The study is designed as analysis of secondary statistics. In order to examine the added value of PSE the information from the following state registries was combined: Estonian Education Information System, Tax and Customs Board, Social Insurance Board and Unemployment Insurance Fund. The sample included 7278 graduates from 16 PSE institutions in Estonia, who had started their studies in 2013 and graduated in 2016 (Table 1). Their earnings (in real value, adjusted according the change of index of consumer prices) covered the period from 2012 to 2017. Four areas: engineering, information technology, economics and natural sciences were compared.

Table 1. Sample overview.

	Engineering	**Information technology**	**Economics**	**Natural sciences**	**Total**
Tallinn University of Technology (TalTech)	1155	460	1038	207	2860
Other PSE institutions	341	577	2769	731	4418
Total	1496	1037	3807	938	7278

Source: Authors' calculations.

In order to assess the impact of obtaining PSE for earnings difference-in-differences (DID) method was used. A DID estimator requires repeated observations of the treated and nontreated groups. Whereas the before-after estimator compares the outcomes of the treated group after the change to the outcomes before the change, the DID estimator eliminates common time trends by subtracting the before-after change in the non-treated outcomes from the before-after change for the treated outcomes (Caliendo & Hujer, 2005). DID integrates the advances of the fixed effects estimators with the causal inference analysis when unobserved events or characteristics confound the interpretations (Villa, 2012).

The numerical value of the DID estimator can be obtained from a regression formulation. Let *Tt* be a time dummy that switches on for observations obtained after the policy change and *di* be a dummy for people in the treatment group.

$$y_{it} = \alpha X_{it} + \beta_1 d_i + \beta_1 T_t + \gamma(d_i * T_t) + u_{it}$$

This model includes two main effects for treatment and time and an interaction term indicating treatment status, which is a dummy variable that marks observations from treated subjects after policy change. The coefficient γ in front of it indicates the treatment effect. This kind of regression formulation of the DID model offers a convenient way to construct DID estimations with standard errors (Angrist & Pischke, 2009).

The relationship between earnings and education was assessed using ordinary least squares (OLS) method. The assessments were based on Mincer's earnings formula, which pre-supposes that dependent variable or earnings is exponentially increasing function regarding independent variables (Humphreys, 2013). The assessments of coefficients in Mincer's earnings formula indicate by which percentage income increases/decreases, in case respective independent variable changes by one unit. Mincer's earnings formula takes the following form:

$$\ln(\text{wage}_{it}) = \alpha X_{it} + \beta_1 \text{University}_i + \beta_1 \text{PostEntry}_t + \gamma(\text{University}_i * \text{PostEntry}_t) + u_{it}$$

Where $\ln(\text{wage}_{it})$ is individual i's the natural logarithm of wage in period t and X_i is a vector of control variables.

The regression model included comparison of treated and nontreated groups' indicators before and after the change:

- Dummy variables regarding treated and nontreated groups and time period (pre- and post-entry);
- Interaction term: impact of studying at Tallinn University of Technology (University$_i$ * PostEntry$_t$).

4. Results

The change in earning pre- and post-entry is statistically significant only in economies (6.8% increase). Although not statistically significant, it was the lowest in natural sciences (0.3%).

In terms of demographics, holding all other variables constant the results of the analysis indicate increases in age and being male provide higher earnings post-entry in all areas: engineering, information technology, economics and natural sciences (Table 2). Age leads to increased earnings especially in engineering (36.6%), but also in natural sciences (32.9%). Being male is the least important in economics in terms of post-entry added value (6.2%). The number of children is statistically significant only in engineering, where having more children leads to lower post-entry earnings.

Regarding activity rate of persons and the types of activities, studying in parallel to working leads to lower earnings in all areas under study. The effect is the most pronounced in natural sciences (46.7%). The same applies as could be expected to being unemployed or looking for a job, which means it leads to a lower earnings (except in natural sciences where the results are not statistically significant). Various family benefits (incl. family allowance and parental support) and social benefits (either provided by the state or local government) also lead to lower post-entry earnings, as these measures are designed to substitute for the lack of earnings, namely in information technology and economics.

Entrepreneurship-related activities assessed via two proxies: earning dividends and being self-employed, have different impact. When earning dividends (consisting of dividend income and equity disbursements) leads to higher post-entry earnings in information technology and economics, the impact of being registered as a self-employed person is not statistically significant in any of the areas. Earning dividends is, however, especially important for higher post-entry earnings in economics (34.1%).

University context also plays a role regarding the added value. Having studied in TalTech (the only university of technology in the country) leads to higher earnings in two areas: information technology and economics, while in engineering and natural sciences studying in other HEIs provides a larger increase in earnings. Studying in TalTech has led to increased earnings in information technology to the extent of 29.4% and in economics 11.5%.

Table 2. Difference-in-differences assessments by areas.

	Engineering	Information technology	Economics	Mathematics and natural sciences
	Coefficient	Coefficient	Coefficient	Coefficient
Age in given year	0.366*** (0.026)	0.285*** (0.033)	0.278*** (0.012)	0.329*** (0.055)
Age squared	-0.005*** (0)	-0.004*** (0.001)	-0.003*** (0)	-0.005*** (0.001)
Gender (female vs male)	-0.245*** (0.037)	-0.233*** (0.055)	-0.062** (0.031)	-0.214*** (0.06)
No. of children	-0.131** (0.052)	-0.018 (0.047)	-0.04 (0.025)	0.025 (0.146)
Studying	-0.296*** (0.045)	-0.386*** (0.053)	-0.252*** (0.028)	-0.467*** (0.082)
Unemployed	-0.201** (0.083)	-0.418*** (0.132)	-0.161*** (0.052)	0.035 (0.129)
Receiving family allowance	0.076 (0.076)	-0.121 (0.094)	-0.233*** (0.039)	0.087 (0.119)
Receiving parental benefit	-0.233 (0.414)	-0.781*** (0.268)	-0.211** (0.085)	-
Receiving state social benefits	-0.085 (0.232)	-0.525*** (0.136)	-0.238* (0.124)	-0.236 (0.339)
Receiving local government social benefits	0.062 (0.122)	0.019 (0.121)	-0.1* (0.059)	0.074 (0.136)
Self-employed person	0.21 (0.327)	-0.055 (0.541)	0.058 (0.179)	0.009 (0.852)
Receiving income from dividends	-0.043 (0.096)	0.2* (0.112)	0.341*** (0.066)	0.266 (0.183)
Constant	1.037*** (0.392)	2.433*** (0.481)	2.02*** (0.19)	1.638* (0.787)
PostEntry (=1 since 2014)	0.092 (0.092)	0.059 (0.078)	0.068** (0.035)	0.003 (0.087)
University (=1 if TalTech)	0.05 (0.086)	-0.035 (0.095)	0.027 (0.054)	-0.124 (0.136)
DID (=1 if University=1 & PostEnry=1))	0.08 (0.099)	0.294*** (0.11)	0.115* (0.063)	0.045 (0.156)
R2	0.415	0.413	0.378	0.235
F-statistic (p-value)	69.913 (0.000)	45.94 (0.000)	153.599 (0.000)	20.201 (0.000)
Observations	1496	1037	3807	938

Source: Authors' calculations. Note: ***p<0.01, **p< 0.05, *p<0.1

These results are robust to the choice of control variables. We also split the graduates into age (up to 24 and above) and wage groups. The results indicate significant differences for pre- and post-entry earnings for the under 24 years old group, but not for wage groups.

5. Discussion and conclusion

The paper aimed primarily at examining the change in earnings of graduates from Estonian post-secondary institutions. The additional aims included building a research platform for further research into graduates' earnings and demonstrating the feasibility of linking educational, tax and social benefits data.

The results indicate there are differences between areas in terms of pre- and post-entry earnings. In engineering, holding all other variables constant, older age, being male and having smaller number of children, provide higher post-entry earnings. Studying and being unemployed leads to decrease in earnings. Having studied natural sciences is to some extent similar to graduating from engineering, although they don't share a similar knowledge base (Asheim & Gertler, 2005). What is unique for natural sciences is that in this area studying while working leads to the largest decrease in earnings, indicating the difficulties in accommodating studies and work life.

Information technology and economics differ from engineering and natural sciences as receiving social and family benefits leads to decrease in earnings in these areas, whereas earning dividends leads to an increase. In information technology and economics, also having graduated from TalTech leads to larger increase in earnings. Economics is, however, different from the other areas in terms of the significance of gender as being male has the least significance for increased earnings and earning dividends has the largest.

The study contributes to our understanding of added value of PSE by combining data from different sources and linking educational, tax and social data. It examines the change in earnings pre- and post-entry, rather than analysing the total earnings of different graduates' groups. The study also offers implications for future research. Further studies should examine in more detail the differences between study levels (bachelor, master and doctoral) and include additional fields (with symbolic knowledge base). Also, work experience and academic excellence data was unavailable for the current study, but further studies should include the length of work experience and graduates' abilities.

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Boosting employability through the use of Authentic Learning Scenarios

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Abstract

Education for employability is one of the greatest challenge for Higher education institutions in Europe, but especially in Spain. The European Higher Education Area assumes that competence development becomes crucial to connect higher education curricula with evolving labour market demands. The Authentic Learning Scenarios foster the competence development bringing work experience to the formal learning. Considering that online learning methodologies seems to have a relevant role into a life long learning perspective to achieve authentic learning environments is a singular challenge.

We have introduced the authentic learnig scenarios attributes into a specific subject and we have tested its impact on students competence profile. Apart from testing if the new subject design is effectively atuthentic, the findings show that when the learning process includes authenticity the students perception about their perfomance in the competence more relevant for the job market improves.

Keywords: Employability; Authentic learning; Generic skills; Financial education.

1. Introduction

One of the cornerstones of the European Higher Education Area (EHEA) is its emphasis on a higher education that prepares graduates for a profession. Within this context, competencies play a key role in the design of degree courses because they constitute dynamic elements that enable higher education institutions to address the changing needs of society. In this setting, generic competencies become particularly relevant for the job market. The Higher Education programmes and curricula have to guarantee that the competency profile of graduates meets the job market needs. This context of education for employability that turns around the competence development requires innovative pedagogies. The Authentic Learning Scenarios (ALS) foster the competence development bringing work experience to the formal learning in Higher Education Institutions.

To assess if the introduction of authenticity in learning, as an attribute of learning tasks and environments, boosts increases students' employability through a better competence performance we have redesigned a subject (Financial statements analysis, included into an online bachelor of Business Administration) under the precepts established by ALS theory. The structure of the remainder of the paper is as follows: Section 2 summarizes the background of the ALS theory, Section 3 presents methodology, Section 4 shows the results and Section 5 presents the conclusions of the study.

2. Review of literature

Education for employability has been the mantra of the EHEA since its inception. The keystone of this reform is an emphasis on a career-oriented university education that enhances graduates' employability. Since then, the socioeconomic environment has undergone substantial changes that have reinforced the relevance of this founding principle based on employability. The most critical was the recent economic recession.

The will to strengthen the connection between higher education curricula with the demands of the labour market has modified the design of programs and learning strategies. In a macro level learning perspective, the most important change was the new competence-based orientation. Competencies came into a dynamic point of reference that gives universities the necessary flexibility for them to address the demands of a changing society (Tymon,2013; Gonzalez & Wagenaar, 2003, 2005).

In this context, several papers have researched the competency framework that the job market requires to graduates, specifically business graduates (Burchell, Hodges, & Rainsbury, 2001) and the gap between these and the competencies that graduates effectively acquires in the university (Hodges & Burchell 2003). Despite the results shows many diferent sets of competencies and their relative importance, there seems to be some

consensus on the fact that they all emphasise the importance of personal attributes above technical skills (Tymon, 2013). Taking into consideration these previous skill frameworks and as a part of an Erasmus plus Programme (Orellanas et al, 2017) we carried out an online focus grup involving teaching staff, undergraduates, graduates, career counsellors and employers' representatives from Germany, Sweden and Spain. As a result we obtained a taxonomy of the employability demanded.

In a micro level learning perspective, the challenge has been the reorientation of the different subjects towards a more labour connected performance. So, the design of the learning process through ALS is becoming a successful approach. While real businesses, together with traditional course teaching methods primarily have served as tools for the development of skills and authentic learning processes. It is a more radical approach in building an entire course of studying on authentic activities and tasks (Scalon, 2011).

A large scale of employers argue that, in order to boost the employability of graduates, it is essential to reduce the gap between the application of knowledge in the real work environment and the theoretical learning in the formal instruction. Too often students are taught in a largely decontextualized manner in the classroom (Resnick, 1987). According to (Brown, Collin & Duguid, 1989) a way to bridge this gap is to the use a model of cognitive apprenticeship. This model is designed to "enculturate students into authentic practices through activity and social interaction" (p.37). These authors outline three fundamental characteristics of cognitive apprenticeship:

(1) Learners have continual access to models of expertise-in-use against which to refine their understanding of complex skills. (2) Apprentices often have several masters and have access to a variety of models of expertise which leads to the believe that there may be different ways to carry out a task, and that no one individual embodies all the knowledge and expertise. (3) Learners have the opportunity to observe other learners with varying degrees of skill. So, meaningful learning only occurs while it is embedded in a social and physical context. Cognitive apprenticeship originates in the interaction of various components, such as the learner, the learning environment and the task (Barab, Squire & Deuber, 2000).

Following this approach, different authors have made contributions on how learning should be developed through authentic practices based on authentic activities and social interaction. While some authors (Savery & Duffy, 1996) have argued that only real-problem contexts should be presented to guarantee authenticity, other authors (Alessi, 2000; Herrington & Herrington, 2006) shown that maximum fidelity, does not necessarily lead to maximum effectiveness in learning. Rather than the physical authenticity, the cognitive authenticity must be the cornerstone of the learning design (Smith, 1987; Herrington, Oliver & Reeves, 2003). In any case, if the students are not learning in a context of

internship in a real company, they must be provided with an authentic learning environment (Herrington, Oliver & Reeves, 2007). This context should reflect how knowledge will be applied in practice, through authentic activities. Previous studies have established that learning is best facilitated in learning environments that reflects the way the knowledge will be used in real life (Herrington, Reeves & Oliver, 2010). The authors have identified nine elements of authentic learning as criteria for assessing the degree of authenticity of a learning environment. These criteria are (Herrington, Reeves & Oliver, 2010):

(1) Provide authentic context that reflects the way the knowledge will be used in real-life. (2) Provide authentic activities. The e-learning courses need to provide ill-defined activities that have real-world relevance, and which present a single complex task to be completed over a sustained period of time. (3) Provide access to expert performances and the modelling of processes. Authors recommend methods which are not teacher-centric, but border-crossing and collaborative. (4) Provide multiple roles and perspectives. Authors recommend to give opportunities to work with agents from other professions/disciplines. (5) Support collaborative construction of knowledge. This is especially relevant in an e-learning context. (6) Promote reflection. The e-learning course needs to establish an authentic context and task to enable meaningful reflection and self-reflection. (7) Promote articulation. The authentic tasks to do need to incorporate inherent opportunities to articulate the public presentation of arguments to enable defence of a position. (8) Provide coaching and scaffolding. The authors emphasize that this coaching and scaffolding role can be exercised not only by teachers but by peers and experts. (9) Provide authentic assessment of learning within the tasks. The assessment should be seamlessly integrated with the activity and should provide appropriate criteria for scoring the complex tasks of the students

Within this context and given the opportunities that offers this pedagogical approach, we have designed and implemented an authentic learning scenario in a specific subject to answer the main research question: Do the ALS improve the required skill to foster the employability of Higher Education graduates? Therefore, we have tried to answer this question in to steps: a) Does the design of the subject reflects an authentic learning scenario? b) Does the authentic learning scenario boost the employable competences of the students?

3. Metodology

The study has been focused on the application of ALS in an online environment as it has been made at Universitat Oberta de Catalunya, a fully online university with headquarters. Also, it has been applied to a subject on a degree with a large volume of students and graduates the Bachelor's degree in Business Administration (BA). The degree of BA, which

has more than 5,000 students, constitutes one of the key degrees of the University. It is also a regular educational offer in universities around the world. The subject, named Analysis of Financial Statements, is a compulsory and advanced subject within the degree. Besides, it is very relevant to one of the most common professional profiles of graduates in BA, a financial management assistant.

The study was carried out with experimental design of one factor. It carried out during a full semester on the students in the subject of analysis of the financial statements. The control group was formed by the students who had studied the subject the previous semester to the one of the study. The response to the control group survey was of 86 students (25% of the total) and the study group of 49 students (15% of the total). The descriptions of age and sex are similar in both samples. In addition, 60% of the students that have answered, nowadays have jobs related to the studies they are currently studying.

3.1. The learning environmental and the tasks

The principles of authentic learning guided the redesign of the subject, and the learning activities were focused on performing realistic and complex tasks. The virtual class recreated through videos the meetings held between the Financial Director of a company, the professor of the subject, and his newly appointed assistant, the student. The objective set for the associate was to prepare a professional financial report about the economic and financial situation of the company that would be presented by the Financial Director at the next Board of Directors. In the initial meeting (first video), the assistant is commissioned by the head, and four more meetings are arranged to compare the evolution of the assignment.

Students were asked to carry out four learning activities on an individual basis that would provide them with the theoretical and practical foundation for preparing the financial report. However, in each of the four activities, the financial director raised an uncomfortable question to the assistant. He wanted to know his opinion regarding the impact of the conclusions obtained in the decision making process that affect other departments of the company such as the general management, production, human resources or marketing department. The assessment was continued throughout the whole semester and the student received for each activity a qualification and a personalized comment that could be used to improve the final report.

3.2. Measure instrument and data analysis

The tool for measuring it has been an anonymous online survey for all students enrolled at the end of the teaching period (354 in the control group and 329 for the study group. The survey included a set of demographics, a group of questions related to the achievement of the 16 skills that promote employability identified Erasmus plus Program (Orellanas et al,

2017) and another group of questions related to the performance or not of the 9 elements that characterize an authentic learning (Herrington & Oliver, 2000; Herrington , Reeves & Oliver, 2010). The answers were Likert type of five degrees. The analysis of the data consisted in the comparison of the averages between the control group and the study group. As the variables did not follow the distribution of proportions of the Normal Law, was used the *U* test of Mann-Whitney's for two independent samples.

4. Results

With the analysis carried out, the two questions raised in the study have been answered. About the first of them Does the design of the subject reflects an authentic learning scenario? the answer is yes as shown in table 1. The average and standard deviation of the attributes indicate that the redesign of the subject has allowed to improve the perception of the students on to what extent the subject reflects the reality of the professional context of a financial director (values greater than 3 except in the item related to group work, logically if we consider that the job of the job that is replicated is primarily individual and not group). And the contrast statistic indicates that the differences are significant in all the elements except in two of them, not invalidating the results because the redesign did not need to increase the high support that they already received from the teacher nor the neatness and refinement of the performances.

Regarding the second question Does the authentic learning scenario boost the employable competencies of the students? shows in table 2 that students have perceived that skills for employability, according to the Skill-up study, have improved in the study group (averages almost in all the items of the higher study group those of the control group). And this improvement is statistically significant in nearly all of them. Therefore, the students perceive that, with the current design of the subject, the level of competence for employability is higher. But not only that, but also the students themselves see that they have improved, especially in those that are relevant to their employability.

5. Conclusions

The increase in employability is one of the fundamental objectives of the European Higher Education Area. Also, UNESCO in its 2030 agenda seeks to ensure inclusive and quality education for all and promoting lifelong learning (ODS-4). At this point, e-learning plays a key role as a provider of lifelong learning.

According to the literature, the use of ALS contributes to the improvement of student employability. Through this research, it has been shown how these scenarios also contribute to improving employability in an e-learning context and in a subject of a degree that is not

practical. It is necessary to continue investigating to analyze to what extent these results are extrapolated to other subjects and disciplines.

Table 1. Statistic of the elements of authentic learning

Authentic learning attributes	Descriptive statistics		Contrast statistic [2]
	Study. n=49. M (SD)[1]	Control. n=86. M (SD)[1]	
Context course represented real	M=4,49 (0,51)	M=4,08 (0,83)	**Sig=0,004**
Task real	M=4,39 (0,61)	M=4,02 (0,91)	**Sig=0,026**
Task complex problem	M=4,16 (0,75)	M=3,76 (0,93)	**Sig=0,017**
Chose information	M=4,39 (0,70)	M=3,84 (0,93)	**Sig=0,000**
Externalizable task and strategies	M=4,39 (0,53)	M=3,90 (0,78)	**Sig=0,000**
Access expert	M=4,24 (0,88)	M=3,36 (1,12)	**Sig=0,000**
Different view	M=4,12 (0,73)	M=3,55 (1,05)	**Sig=0,001**
Group effort, rather individual effort	M=3,10 (1,39)	M=1,81 (1,08)	**Sig=0,000**
Decisions complete task	M=4,20 (0,87)	M=3,24 (1,08)	**Sig=0,000**
Compare experts	M=3,82 (1,11)	M=2,94 (1,31)	**Sig=0,000**
Reflection group	M=2,94 (1,38)	M=1,87 (1,06)	**Sig=0,000**
Task enabled arguments	M=3,80 (1,04)	M=3,20 (1,24)	**Sig=0,004**
Teacher support	M=4,27 (0,86)	M=4,10 (1,02)	Sig=0,417
Performance polished	M=4,12 (0,70)	M=4,19 (0,86)	Sig=0,365
Activity extend periods	M=4,16 (0,90)	M=3,85 (0,98)	**Sig=0,037**
Multiple assessment	M=4,12 (0,75)	M=3,27 (1,21)	**Sig=0,000**

[1] M= Average; SD= Standard Desviation. [2] Contrast done with the nonparametric test U from Mann-Whitney

Table 2. Statistical of the improvement of the competences for the employability ordered according to the relevance of each one of the competences assigned by the student

Competences for employability	Competence relevance % total	Descriptive statistics		Contrast statistic [2]
		Study. n=49. M (SD)[1]	**Control.** n=86 M (SD)[1]	
Analytical thinking	14,1	M=4,55 (0,94)	M=4,15 (0,78)	**Sig. =0,000**
Problem-solving	12,5	M=4,27 (0,93)	M=3,77 (0,86)	**Sig. =0,000**
Decision making	9,9	M=4,31 (1,14)	M=3,92 (0,88)	**Sig. =0,000**
Teamwork	9,7	M=2,69 (1,53)	M=1,80 (0,92)	**Sig. =0,010**
Foreing lenguage	7,3	M=2,57 (1,56)	M=1,56 0,81)	**Sig. =0,000**
Comunication skills	6,4	M=3,53 (1,28)	M=2,67 (1,21)	**Sig. =0,000**
Digital skills	5,9	M=3,90 (1,16)	M=2,92 (1,11)	**Sig. =0,000**
Self-management	5,9	M=4,31 (0,92)	M=3,99 (0,91)	**Sig. =0,018**
Results orientation	5,7	M=4,22 (0,80)	M=4,08 (0,76)	Sig. =0,216
Capabilily cope with changes	5,1	M=3,67 (1,27)	M=3,02 (1,26)	**Sig. =0,003**
Creative thinking	4,8	M=3,96 (0,98)	M=3,26 (1,05)	**Sig. =0,000**
Stress management	4,0	M=3,59 (1,27)	M=2,50 (1,31)	**Sig. =0,000**
Conflict management	3,5	M=3,49 (1,37)	M=2,51 (1,25)	**Sig. =0,000**
Learning to learn	3,1	M=4,12 (1,03)	M=3,40 (1,09)	**Sig. =0,000**
Cross-cultural and diversity	1,1	M=2,98 (1,42)	M=2,51 (1,18)	**Sig. =0,047**
Subject-specific skills	1,1	M=4,10 (0,96)	M=4,19 (0,90)	Sig. =0,630

[1] M= Average; SD= Standard Desviation. [2] Contrast done with the nonparametric test U from Mann-Whitney

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Using Alumni Entrepreneurs Feedback to shape University Entrepreneurship Education

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Abstract

It is accepted by most agencies that enterprise education is important for students and for the economy, however it is often difficult to measure the effectiveness of this education as effects can take many years to be shown. We have collected qualitative data from over 300 alumni entrepreneurs, reflecting on their time at the University of Manchester, which suggested that their experiences of enterprise education were mixed and that they would have benefitted from more practical courses rather than more academically interesting topics. For example they wanted training on how to register a company, understanding tax, employment law and basic book keeping, rather than how to generate ideas and theories of innovation and entrepreneurship. There is a clear need to shift some enterprise education to cater for those who have an idea now and need practical advice, or may have an idea in the future from their subject area and need to know how to proceed formally. On curricular courses are more likely to be academically and theory driven, especially with the need to provide appropriate assessment for students, whilst it is often the extracurricular activities which provide more practical details in how to start a business, which may not be open to all students, or may not be well advertised. Since many students don't start a business until later in life, with activity peaking in the 35-60 year old age group, they often do not take advantage of these opportunities while at university, should they be available. Our paper shows there needs to be a better mix of practical with academic courses to provide for alumni entrepreneurs' needs to allow them to start a business whether it be straight form university or later on in life.

Keywords: Alumni; Entrepreneurship and Enterprise Education; Employability; Impact; Training.

1. Introduction

From its inception more than fifty years ago, the availability and breadth of entrepreneurship and enterprise education on offer has grown considerably, and although the outcomes are broadly positive, there are mixed views as to its effectiveness, with difficulties in measuring success particularly because of the time delay often between students graduating and starting a business later in life. However, all agree from policy makers, industry and employers to universities and students that entrepreneurship education is something students should be doing at university to some degree whether they end up starting their own business or working in a corporate environment (Volkman et al., 2009, Gibb, 2005). As a secondary effect, many studies have found that those alumni who have participated in enterprise education are more likely to be employed, earning a higher salary, and less likely to be underemployed that those who have not participated (EC 2015).

Initially entrepreneurship in university settings was about new venture creation, including those interested in university spin-outs but has come to include intrapreneurship as corporates often lose their entrepreneurial drive as they grow and more recently social entrepreneurship. Entrepreneurship has been defined by the QAA (2018) as the creation of social, cultural or economic value by creation of a venture. Intrapreneurship has been defined as the application of enterprising behaviours and skills within an existing organisation. Finally, Enterprise is a broader definition as the generation and application of ideas using a range of skills. Enterprise education focuses on equipping people with entrepreneurial skills and mind-set in a variety of contexts and is often linked to employability. Enterprise education generally includes any enterprising skills which could be used in a new workplace to create value (financial, social or cultural). Enterprise education is often linked to employability and many chartered bodies which oversee degree courses such as engineering, computer science and life sciences require commercial awareness to be included in all courses. Current data suggests approximately 5% of UK students are self-employed six months after leaving university, with 0.6% having started their own business (HESA 2017).

Enterprise education is often offered now university wide in the UK – not just to business school students, many students are interested in commercialising their ideas from other subject areas (Smith et al., 2007, Jones et al., 2015). Enterprise education has a shown a wide range of effects. Some has no effect on entrepreneurial intentions or actual business creation. Some has shown an initial increase in self-efficacy followed by a slow decline; others show an increase in venture creation. Some training shows a negative effect, as people realise that the reality of entrepreneurship is harder than they thought and they realise it's not for them (perhaps not a bad thing to find out early). Meta-analysis has

shown that overall there is a slightly positive effect of entrepreneurial education (Nabi et al., 2017). However, it seems an entrepreneurial ecosystem with inspiration and practical help is a good mix. There have been many other secondary benefits to enterprise education such as improved communication, presentation and team working skills (EC 2015).

On curricular courses include Masters courses with the aim of starting a business (Phillips and Styles, 2006), modules for entrepreneurship for business school students, optional or compulsory modules on entrepreneurship for those taking non-business degrees around the university, embedded entrepreneurship content such as case studies in modules within degree subjects, or for MBA students specific modules on entrepreneurship. Off curricular activities can include business plan and ideas competitions, hackathons, entrepreneurial speakers, skills workshops (e.g. starting a business, networking, creativity), on- or off-site boot camps (Phillips, 2017) and events where students can meet with entrepreneurs and these activities tend to be available university wide (Phillips, 2010, Phillips, 2018). On curricular courses often contain topics such as opportunity/problem recognition, market research, intellectual property, business planning, finance and sources of finance. Use of models such as PEST, Porters, SWOT and the Business Canvas are also common. Some courses also study traits of entrepreneurs and characteristics of entrepreneurial businesses. The need for assessment is also an issue – moving away from exams and more towards learning by doing such as suggested by Kolb Learning Cycle (1984) with assignments, posters, business plans, elevator pitches, personal reflective journals (Phillips, 2008), and problem based learning (Sanchez-Romaguera and Phillips, 2018). Universities are now using a variety of teaching methods and assessments in order to achieve enterprise education outcomes (Jones et al., 2015) where learning by doing is generally accepted to be more effective. The benefit of some off curricular activities such as business plan competitions is that there is further support from funding (often of the order of £10,000), publicity and in-kind support such as incubator space, mentoring and access to Intellectual Property lawyers.

Many scholars have studied the impact of enterprise education (for example, Fayolle and Gailly 2015, Oosterbeek et al., 2010, Matlay, 2008, Souitaris et al., 2007, Vesper and Gartner 1997) many students start a business later in life so longitudinal studies looking at venture creation may last many years – in fact data suggests venture creation is highest between the ages of 35-60. Self-efficacy and confidence are also commonly measured, but it is found the positive effect of a period of training can subside over time, and indeed, sometimes the entrepreneurial intent reduces as the student realises how hard starting a venture could be and the high chance of failure.

It is difficult for students to understand what might be needed to start an entrepreneurial venture before they have gone through the experience themselves and even staff with entrepreneurial experience within the university are likely to have gained this by spin-out

company formation with help from the university and with the security of an academic position, so, students have a better idea once they have started a venture what they are likely to need so it was decided to contact alumni that had started a business to understand what else they would have preferred to see in training whilst at university.

We contacted alumni entrepreneurs to try to understand what type of enterprise education they felt worked well and what could universities do to better support students who might become self-employed upon leaving university.

2. Methodology

It was found that there were more approximately 10,000 alumni from the University of Manchester (approximately 2.5% of the database) who identified as being self-employed; a survey was advertised to these alumni who had set up businesses via LinkedIn, alumni newsletters and emails. It was self-selecting for those that respondent to the call to respond and 278 respondents replied to the survey and was administered via Surveymonkey.com. Respondents were from Engineering and Physical sciences (35%), Humanities (20%), Business (17%), Biological/medical sciences (11%), other (16%). Their terminal qualification were Bachelor's degree (44%), Taught masters (37%), MBA (4%) and Doctorate (14%). Respondents were a variety of ages and had attended the university across several decades. Some had well established businesses; others were relatively new so we were able to collect a wide spectrum of view covering many years.

The key questions asked were did you feel university prepared you well for self-employment and open comments on what they feel could have been done better. Data was collected from survey and qualitative comments analysed.

3. Results and Discussion

Firstly, alumni were asked in general whether they felt that the university had prepared them well for self-employment and the responses were mixed, but with 33% suggesting their experience was below average and only 15% saying very well it is clear that alumni feel much more could be done.

Table 1: How well did the University prepare you for self-employment?

How well do you feel University prepare you for self-employment	% of Responses
Very Well	15.8
Quite Well	20.9
Average	30.2
Poorly	10.4
Very Poorly	22.7

Qualitative Comments

In general, comments suggested that courses in entrepreneurship should be more practical dealing with the basics of registering a company and how the business functions. The answers were broadly split into practical skills (P), Gaining experience (E) and Networking (N). It should be noted that many older graduates had no specific training available to them, further than having done a general business degree or MBA course that they might have taken at university.

Table 2: Comments made by Alumni Entrepreneurs

Comments made by Alumni Entrepreneurs
Training provided should be practical and relevant (P)
Universities should teach the basics of financial management (P)
Basic accounting should be taught (P)
Financial spreadsheets (P)
Budgeting should be taught (P)
How to register a company and the differences between the types of company structure (P)
Understanding taxation (P)
More opportunities for networking with entrepreneurs (N)
Arrange platforms to be able to speak to entrepreneurs in an informal setting (N)
Opportunities to work in a start-up /intern in a start-up not just corporates (E)
Work placements with self employed (E)
Possibility of doing an industry year out with self-employed not just big organisations (E)
Offer coaching and mentoring in specific cases for those with ideas (P,N)
University could offer more funding for start-ups (P)
Signposts to funding and further advice to take an idea forward (N)
Offer personality testing (P,E)
Doing practical projects (with entrepreneurs) (E)
Putting people in touch with each other who are interested (N)
Connecting people e.g. with business students or web/app developers (N)
Some said the university shouldn't be teaching entrepreneurship (-)

Previous data (Phillips, 2018) suggests that only 33% from a cross section of alumni were exposed to any entrepreneurship activities at university, so despite more activities being now available to younger graduates, it is possible these are not being advertised visibly enough.

4. Conclusions and Recommendations

From the results, it is clear that alumni entrepreneurs feel a shift towards increasing more activities that focus on practicalities is required. We suggest it could be offered extracurricular and would not necessarily need to be run by academics, but by the Chamber of Commerce, accountants or entrepreneurs themselves. This would be of benefit to those who are intending to start a business on graduating and will also help those students who will likely be self-employed (but not necessarily considered entrepreneurs) as a normal part of their job e.g. journalism, pharmacist, consultant etc. However, due to the latent nature of graduate start-ups, it is important to market these activities appropriately emphasising why commercialisation and practical entrepreneurial skills are important even for those in pure academia where a the academic may found a spin-out venture. Some student feedback from entrepreneurship courses (especially those that are compulsory) complains that students do not see the relevance of the course to their own work. We suggest there is more scope to focus purely on practicalities with extracurricular activities as no assessment is required, and a self-selecting audience of interested potential entrepreneurs.

Networks are important with joined up activities where things can move to the next stage, including more guidance for what they could do next – such as following a pipeline with overt links with accelerators and incubators and a commitment to help graduates after they have left. This is a common concern of students once they leave – providing a smooth transition from student entrepreneur to the commercial world. Alumni mentioned networking as an important aspect – to meet entrepreneurs in a more informal setting and also like minded students who could be potential co-founders or those with specialist skills such as coders and developers.

Many entrepreneurship courses and activities both curricular and off curricular offering topics of academic interest but clearly many entrepreneurs have ideas from elsewhere (so do not necessarily need creativity) and need to focus on practicalities. Undergraduate courses tend to be more general enterprise education as the relatively low numbers that start a business, so this enterprise education is used in an employability capacity and innovation studies / entrepreneurial studies are easier to assess in a more traditional manner. As far as existing entrepreneurship education is concerned, it should try to include practicalities of starting a business as well as the more intellectually stimulating activities such as creativity, innovation and studying entrepreneurial companies and models.

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Enhancing learning environments through partnerships in an attempt to facilitate school effectiveness

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Abstract

South Africa (SA) is a developing country struggling to address educational transformation inherited from a previous apartheid regime and created by the current democratic government. Education is an area which is struggling within a SA context. Many schools in disadvantaged communities are faced with inadequate infrastructure and lack of resources yet the expectation is for schools to show evidence of effectiveness irrespective of these challenges. This context prompted an investigation into the development of the school learning environment utilising a participatory action research design at a disadvantaged primary school in the Western Cape, SA. The major findings included that the school learning environment was influenced by the unique challenges and pressures in the school context; that collaborative efforts between stakeholders contribute to school effectiveness irrespective of context through acknowledging the school as an organisational system which requires the principal, educators, parents and community to effectively collaborate through open channels of communication in order to facilitate optimal teaching and learning environments which contribute to school effectiveness. The community component in the school learning environment needed to be acknowledged as the validation of the experiences of educators, learners, parents, principal and community is important in the South African context.

Keywords: Education; school effectiveness; learning environments, partnership; collaboration.

1. Introduction

Within the post 1994 South African (SA) context of change, education is regarded as one of South Africa's key problem areas (Oswald & Perold, 2015, p.2). A report commissioned by the Centre for Development and Enterprise highlighted the South African Education Crisis and the quality of education in South Africa from 1994 – 2011. Some of the key findings from this report were that there was no improvement in South African Grade Six literacy or numeracy performance over the seven year period; South African pupils ranked 10th of the 14 education systems for reading and 8th for mathematics, behind much poorer countries such as Tanzania, Kenya and Swaziland; South African mathematics teachers have below-basic levels of content knowledge; school data showed that of the 100 pupils that start grade one, 50 will drop-out before Grade 12 (most of which happens in grade 10 and 11), 40 will pass the National Senior Certificate (NSC) exam and 12 will qualify for university and that there is a distinct educational divide and effectively two different public school systems in South Africa (the smaller, better performing system accommodates the wealthiest 20-25 per cent of pupils who achieve much higher scores than the larger system which caters to the poorest 75-80 per cent of pupils) (Spaull, 2013, p. 4-7). This summary indicates that the state of education in South Africa is critical and if we really intend to develop the state of education we need to improve the socio-economic status for the majority of South Africans.

Nicolson (2015) reported that 12 million people in SA live in extreme poverty. The Organisation for Economic Co-operation and Development (OECD, 2017) has expanded on the severe economic threat that the poor state of education poses to this country which has a legacy of racial classification and hierarchy based on skin colour. This is particularly evident in the great degree of inequality between previously and still advantaged white schools that have a wealth of resources resultant from a historical background which favoured the white race as opposed to the previously and still disadvantaged black schools where resources are lacking. The challenge of facilitating effective learning environments in this context, given the socio-economic and sociological problems that are direct spin-offs of poverty such as unemployment and low levels of education of parents particularly in disadvantaged communities, places a huge responsibility on the shoulders of the managers and educators at schools. The latter argument is critical given the decentralisation of the state's role in schools post 1994 where partnerships with the community and stronger relationships with 'those closest to the learner' (preferably parents) are encouraged and in fact is a key principle in education reconstruction and legislated within a South African context (Heystek, 2011). Parents, guardians and caregivers of learners are therefore required to participate in the governance structure of the school and inherent in this policy requirement is that communities possess knowledge and resources. The reality though places a huge responsibility on principals and educators as disadvantaged communities are characterised by poverty, unemployment and low levels of education. The impact of poverty is such that parents of

learners from poor schools often have low educational qualifications and have several needs that supercedes educational involvement such as health care and employment (Kamper, 2008, p.2).

Quality educational experiences are largely impacted by the resource capacity of parents in the South African reality. More often than not, parents are not equipped to deal with the complex nature of tasks and concepts particularly in science and mathematics. Singh, Mbokodi & Msila (2004, p. 301) found that "presently, there appears to be insufficient participation of black parents in managing schools…" The reality of context, socio economics and social class is therefore largely ignored yet it plays an important role in the optimal involvement of the community in the school.

Overcrowded classrooms are unfortunately the norm within South African education and Marais (2016, p.1) asserts that it will 'remain a part for the immediate future and perhaps even for the long-term future.' Irrespective of the dire state of education within SA, 'the strategic importance of teachers cannot be denied as they are expected to act as agents of change and have a key role in ensuring that quality education is delivered to all children regardless of context' (Oswald & Perold, 2015, p.2). The impact of overcrowded classrooms does not bode well for quality education and facilitating an ideal learning environment is extremely difficult and may contribute to a challenging learning environment which is not conducive to learning and essentially quality education (Marais, 2016). Developing innovative strategies to overcome barriers to educational success is critical within the South African educational landscape particularly as the aim is to deliver quality education and thus contribute to school effectiveness. Education is complex within the 21st century and therefore new perspectives are required that address how parents, schools, and communities will work together to face these challenges.

The theoretical framework for this study relies on systems thinking as this theory provides a holistic perspective of the world. Rooted in biology, the theory seeks to understand the school as a system, as an integrated whole found within a specific context where various shared environments overlap (Bronfenbrenner, 1979). Bronfenbrenner's (2005) ecological systems perspective is valuable as it recognises the school as a system and calls for a holistic understanding that educators and families are the most influential environment in children's learning and development within a complex set of 'layers'. The ecological model recognises the complexity of the individual's context of development (Mampane & Huddle, 2017). The school can therefore be regarded as an ecological system that is dynamic and which is highly dependent upon connections, affiliations and communications between the system's components, in this case, the principal, educators, parents and learners.

Learning environments therefore need to be investigated within the holistic systems view of the school. This study provided educators, parents, principal and the education department

with an opportunity to contribute to a process of transformation and change in their specific context. The implications of this study therefore delivered an exemplar of a historically disadvantaged school engaging in a participatory action research study with the aim to be effective. The research question for this study was 'What is the nature of the learning environment at a primary school in a sub-economic community with regard to the key role players at the school (principal, educators and parents) and how do these collaborations influence the school learning environment and essentially impact on school effectiveness?'

2. Methodology

A community based participatory action research approach was implemented as it emphasised social action and possibly would facilitate my vision to plough back. The rationale for community based PAR draws on diverse historical influences and is guided by the following principles:

a) It is a collaborative enterprise between the academic researcher and community members which in this case are the principals, teachers, parents and learners. Facilitating a collaborative process is essential as rapport building and establishing trust between the community members is essential as we attempt to facilitate optimal data collection.

b) It validates multiple sources of knowledge and promotes the use of multiple methods of discovery and dissemination of the knowledge that could be produced. The use of this research approach would therefore facilitate that research instruments need to be thoughtfully selected and developed in order to ensure that the data collected characterizes the indigenous knowledge present within the primary school communities.

c) It has as its goal social action and social change for the purpose of achieving social justice.

This research was an intensive exploration of the school learning environment at a primary school over a period of four years. At the time that the research commenced (2014), the principal had just been appointed and had a staff of eleven educators and two non-teaching posts. These numbers have subsequently increased to a teaching staff of twenty and five non-teaching posts by 2016. In 2014 there were 400 learners at the school and in 2017 these numbers increased to 706.

Multiple sources of data were used in the research process as the researcher aimed to capture the importance of contextual detail and in-depth description (Babbie & Mouton, 2006). Quantitative and qualitative data collection tools were utilised in this study which enabled the researcher to explore the rich context while recognizing that multiple sources of evidence

(survey, field-notes, interview comments and digital recordings) will increase convergence of results so that results were triangulated which also contributed to the reliability of the research.

The following chronological steps were followed in the data collection phase of the research:

Step 1: Gathering baseline information at the school regarding the educators' and principal's views of how they experience the actual learning environment vs how they would prefer the learning environment to look like and identify trends.

Step 2: Conducting interviews with key stakeholders (educators, principal and parents) as they work towards facilitating school effectiveness. Critically analyzing these findings.

Step 3: Developing interventions in response to the priority needs identified from step 1 and 2 which included the following activities:

1. Developing a collectively owned mission and vision statement.
2. Supporting parents to understand the CAPS curriculum to assist their children and struggling learners in the school
3. Science laboratory

Step 4: Evaluation of interventions

3. Major findings

3.1. The school learning environment was influenced by the school context

The school learning environment cannot be viewed in isolation within a community and the context of historically disadvantaged communities needed to be recognised and was therefore important. Policy level curriculum reforms which educators were expected to implement, resulted in work pressure due to a lack of resources in the disadvantaged context, the latter was perceived to contribute to ineffective teaching and learning.

3.2. Collaborative efforts with all stakeholders contribute to school effectiveness

There were different levels of collaboration within this school's context. These collaborative efforts were perceived to contribute to school effectiveness however the different levels of collaboration could be enhanced through appropriate capacity building for stakeholders. The need for effective channels of communication was highlighted which would facilitate partnership development. The role of the parents in this school was to contribute to the development of the learning environment through effective participation in their child/ren's education through engaging in regular communication and feedback with educators. The parent body identified a need for an effective communication strategy that seeks to increase their involvement in the school which extends beyond the immediate parent-learner-educator

interaction to parent committees and an active school governing body. Parents need to understand their specific role as it relates to the policy and realise that their involvement is critical to the contribution that the school makes to the community.

3.3. The school as an organisational system was recognised in the development of a collectively owned mission statement

The school needed to be regarded as an organisational system where the interaction, collaboration and partnership between each stakeholder, namely the educators, principal, parents, learners and the community, were central to facilitating school effectiveness. The role of the principal is critical in this system as his leadership employed a distributive / transformational leadership and management approach within the school setting. Organisational development skills were perceived by educators to be valuable and contributed to the learning environment as it provided educators with the opportunity to engage in collaborative, creative thinking processes and collective decision-making.

3.4. The interventions provided much needed resources which facilitated effective teaching and learning

The educators recognised that the collective and collaborative strategic session generated a mission and vision statement that provided the educators with the necessary guidance in the school learning environment and an initial means for quality assurance in their educational setting. The fact that only educators and the principal were involved in the development of the mission and vision was acknowledged and a subsequent review of the mission and vision is planned where parents' input will also be required.

The reading and writing volunteers provide a human resource for the school and function as a support role for educators who are unable to provide struggling leaners with increased individual contact time.

Another major outcome of this research was the science learning centre which was built at the school and represented possibility for the stakeholders as it was perceived to enhance the teaching and learning at the school. The role of the education department would be to acknowledge the school as an exemplar of a community school that explores and facilitated the development of innovative, collaborative partnerships with a higher education institution, principal, educators, parents, and the surrounding community as it seeks to be an effective school and produce successful learners, irrespective of its historically disadvantaged context.

4. Conclusion

An exploration of the unique learning environment context of primary schools and the value that collaborations between the principals, educators and parents added to the classroom

learning environment was valuable in the sense that this knowledge contributed to a unique set of lessons learnt that could be applied to other learning environments thus laying the foundation for the effectiveness of schools.

The study was significant as it provided an exemplar of the developmental aspect of facilitating 'ideal' learning environments through partnerships between principals, teachers and parents and the community at primary school level in a disadvantaged community. This study furthermore contributed to the knowledge of collaborative enterprises and learning environments; specifically within disadvantaged schools. This study provided unique baseline information on partnerships at the primary school level and the intricate balances and support provided at each level of partnership as it aims to improve learning environments and facilitate school effectiveness. External influence and collaborative efforts conducted and implemented in partnership with the school, contribute to educational effectiveness and could possibly influence educational transformation.

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OERlabs: Strategies for University-wide OER Advancement

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Abstract

As part of the project 'OERlabs – jointly training student(-teachers) for Open Educational Resources (OER) use' at the University of Cologne, Germany, various university stakeholders participated in an open developmental process through attending Multi-Stakeholder Dialogues (MSD). The goal was to sensitize and educate student teachers for Open Educational Resources. During a 6-month process the stakeholders collaboratively explored the challenges and developed solutions for initiating and advancing the use of OER during teacher training. This paper provides the solutions developed by the participants with the help of an impact-effort-matrix, which enabled the stakeholders to assess and evaluate all solutions accordingly. A key to this development was the participatory nature and open dialogue process among all relevant stakeholders, i.e. student teachers, administrators, lecturers and university leadership. A majority of the solutions can be described as low-effort but high-impact, therefore showing a promising outlook for further innovation and organizational development in regards to implementing new technologies.

Keywords: Organizational Development; Participatory Design; Open Educational Resources; Teaching Development; Open Education.

1. Open Educational Resources in Higher Education

Ever since the Massachusetts Institute of Technology (MIT) decided to open up some of their courses and share their material publicly via the project 'Open Courseware' ("About OCW", n.d.) the trend for sharing educational content online started to grow. Along the same path the OECD and the UNESCO began to form an agenda and plan various directives to further open up education. Following these proclamations higher education institutions confirmed their motives in a survey for initiating and joining OER projects, namely being morally obliged to share educational resources, enabling all social groups to partake in education, being able to collaborate and cooperate with other institutions and move forward innovative thinking (see Goertz et al. 2007; Hylén, 2006).

In their 2007 world-wide market survey about OER at higher education institutions Goertz et al. discovered a heterogeneous field, wherein differences arose in terms of content, authoring, financing and target-audiences (2007, p. 14). Despite the continuous evolvement, and because of the heterogeneous range of OER initiatives, which were discovered, Goertz et al. concluded that two main factors have to be resolved: better extrapolation of content through transparency of platforms, and clear guidelines for OER (e.g. topics covered, repositories, target audience, authoring and financing) (2007, p. 17).

The work of the OERlabs project settled in between these goals and unfulfilled ideals to guide university stakeholders in jointly developing their university while continuing to work on advancing the 'greater good' of OER-use. As the following paper describes, organizational development is a complex undertaking and requires a specifically steered process (see Andrasch et al., 2018). The university stakeholders collaboratively worked and decided on solutions for OER advancement, which offer practical ideas that can be implemented without additional projects (i.e. funding), as well as potentially transferred to other higher education institutions.

2. Innovation and Development in Higher Education

In many cases, but especially when universities surpass a certain size (e.g. number of students and staff) it can be argued that the management of that type of institution increases exponentially. As Altvater (2007) argues, universities are very unique organizations that could indeed make use of external organizational consulting, but tend not to, because by its own admission a university contains enough experts and innovators in-house (cf. Mintzberg, 1983). But over the years external consulting has crept closer to working with universities through understanding its organizational 'peculiarities': Baecker (2007) describes the duality between organization and institution, wherein universities have an educational mandate, while also having to function effectively and efficiently on an organizational level. On the other hand, Cohen et al. (1972) used the term 'garbage can

model' to describe higher education institutions, meaning that decisions are not made towards specific solutions, but are borne out of a congruence of: decision-making processes, the university stakeholders and their issues, i.e. random papers landing in the garbage can, but still piling up on one another. Lastly universities have been described as organizations that are comprised of 'loosely coupled systems', which in this case refers to the fact that decision-making processes tend to favor compromising solutions among the various institutions, people and their specific agenda, instead of specifically focused effort (Weick, 1976).

Through developing these concepts and methods, initiating change at universities has become its own specialty field, where not only change-management experts are consulted, but research projects are funded, which can deal with these experiences (Kühl, 2007). This is also where the current paper and the project OERlabs docks on. Innovating in the field of education encompasses various forms, and emerging technologies can be considered one of them. A question that has followed around educational institutions for many decades is how technical and social innovations can flourish and sustain. A leading model was developed by Rogers (2003) and is called 'diffusion of innovation'. Rogers (2002) describes diffusion as a social process, where communication takes place over time among the members of the relevant social system. The following part details how the developmental process in our project was encapsulated by the previously mentioned concepts, and followed Rogers' (2003) model.

3. OERlabs: Multi-Stakeholder Dialogue process

One of the key factors in innovating and developing new educational strategies is the participation of all relevant stakeholders. The project OERlabs therefore could draw from many important cohorts inside the university: students and student teachers, lecturers and seminar leaders, administrative staff, library personnel, as well as people form leadership positions. In order to be able to foster appropriate communication among all relevant stakeholders regularly scheduled events were organized, so called Multi-Stakeholder Dialogues (MSD) (Dodds & Benson, 2013; Seufert, 2013). This process took place from the beginning of December until the end of April and consisted of three MSD events, while also providing stakeholders with the opportunity to communicate through various online modes during that same timeframe. This open developmental phase was meant to confront the stakeholders first with openness ideas and methods in general, while towards the final stages the scope narrowed (Andrasch et al., 2018).

4. Proposal of Solution – the outcomematrix

The relevant stakeholders were asked to produce various challenges and appropriate solutions on how to advance the use of OER at the university. Throughout the process the challenges were formulated by the participants, based on their own experiences, as well as based on the discussions and tasks they encountered. The participants constantly shared their views, experiences and opinions during the work processes and also had to create the table and the matrix shown below in groups, and share their findings with the others.

Table 1. Solutions and Challenges developed by UoC stakeholders (translated from German and edited for clarity)

Nr.	Proposed Solution	Challenge Encountered
1	A platform (i.e. the learning management system ILIAS[1]) for collecting material from seminars	Students would like to have access to previously created seminar material
2	Have room for discussion in order to enhance openness: teaching mistakes, insecurities, failings	Sharing is not common among teachers; misunderstanding attitudes towards mistakes, e.g. everything has to be perfect; status of teachers not aligned with correct perspective/role
3	Funding for learning and sharing, similarly as for culture and economy (up to this point only short-term solutions)	Pay-structure for creating OER; Otherwise time constraints for lecturers and teachers
4	Kind of 'Social Media Training' for teachers, i.e. get to know feedback culture, engage in discussions, learn formulation of criticism	Teachers want to convince others to share OER online, but there are reservations about how their material will be received by the community
5	Introduce minimal quality standards for communities, which are provided by/through the community	Teachers are uncomfortable with others' teaching material and wish for regulated material instead; they instead choose not to use OER
6	Using digital and analogue material for PR-work (e.g. print-magazines, homepage, social media channels); finding examples of OER-use for	Promotion of the university's OER-activities; build and raise awareness for OER at the university in order to motivate students and teachers to create/use OER

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[1] Learning Management System in use at the University of Cologne. Cf. Moodle and Canvas, https://www.ilias.de

university-context

7	Initiate a basic seminar where students learn about OER and how to use them	Student teachers should have more experiences with OER during their education (would lead to more awareness among teachers later on)
8	Only using correctly licensed material	E.g. students want to share their re-mixed material; correct sourcing of the re-mixed material is necessary
9	OER platforms (e.g. provided by the university, government incl. visibility and support)	Sharing my created material while reaching the biggest potential audience
10	Platforms and/or sited with pictures and graphics	Creating presentations for seminars, e.g. finding appropriate pictures (legality of use, sources, licensing issues)
11	Offer trainings for teachers where the benefit of a sharing culture (i.e. online cooperation) is at the forefront	Veteran teachers can have negative attitudes towards 'new' ideas and technology
12	Implementation of sharing and re-mix culture into the state bylaws for teacher education	Teachers have to be introduced to cooperation with the help of digital media
13	Work together with information specialists (i.e. libraries); open-data technology; meta-data; central repository for OER; using existing publishing infrastructure	Creating OER-material and reaching audiences so it will be intensively used
14	Teachers should not only create OER themselves, but encourage and teach their students to adapt the materials and integrate it into their personal learning environment; openness is also relevant for actual (learning and teaching) practice	OER do have benefits, but this potential is unused in terms of establishing OER-practices for the learners
15	Provide basic OER-information (principles, repositories etc.) through the homepage of the library	Raising awareness about OER among students and teachers
16	Propose the use of OER in presentations	Problems for documentation of conference at university institute, e.g. pictures/graphics have to be removed from presentations due to copyright issues

17	Clear structure for re-mixing and re-using material, e.g. trainings and guidelines	Lecturers and teachers are unsure about copyright/legal situation of their material, i.e. they do not feel comfortable sharing
18	Community building through platforms; train-the-trainer; hacky hour; self-organization	Service department support lecturers and teachers in their OER-use Linking up interested parties (i.e. scaling OER-use)
19	*Netzwerk Medien*[2] has a broad consulting concept for OER-use; support would also entail OER-workshops	Lecturers and teachers want a 'safe' legal environment in which they can create and use material
20	Technical platform, which enables comments, voting or peer-reviews; agreement about quality criteria and its assessment	Ensuring the quality of the material
21	Instead of providing schoolbooks with OER content, have the ability to create and use own material as OER (especially at the start of the project)	A funded project developed teaching material for higher education and wants to publish them via a repository (ideally Open Access), but copyright a major issue (e.g. schoolbook content), therefore material will not be published
22	(Online) platform where people can find and share guidelines, correctly licensed, categorized and tagged material	Person XYZ would like to re-mix material, but is unable to find and categorize which material can be repurposed
23	Platform where people can find and share guidelines, correctly licensed, categorized and tagged material	An author created good material, but after using it once it is 'lost in the shuffle'

4. Implications and Outlook

After the conclusion of the developmental process, the university stakeholders provided a thorough and practical array of solutions. Having to think and organize their solutions based on the impact-effort-matrix the stakeholders were compelled to take on a more practical perspective as can be seen in Figure 1. In (theory and) practice universities can more easily decide which solutions are obtainable and can therefore more readily engage in

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[2] The *Zentrum Netzwerk Medien* is a competence center at the University of Cologne, which offers service and teaching support regarding media. Further information (in German): https://www.hf.uni-koeln.de/4000

innovating and developing. This factor was key in the methodical decision of using the matrix. An immediate visual representation forced the stakeholders to take step back already during the creation process, and reflect on their past work, as well as their future engagement.
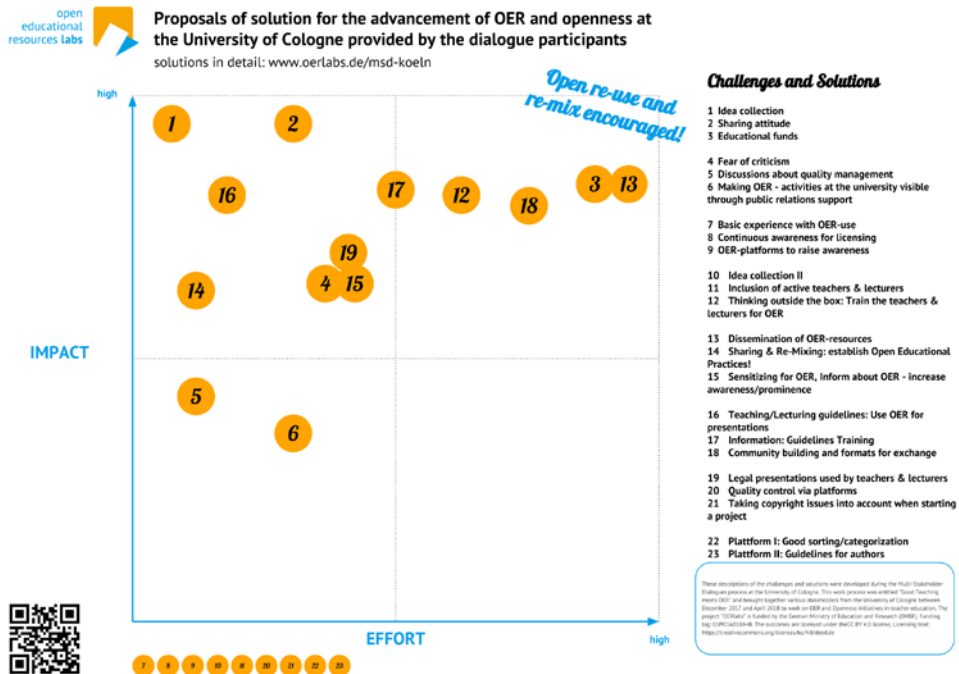
Figure 1. MSD4 Outcomematrix (translated form German, re-useable format via QR-code) (2018).

When discussing the proposed solutions in regards to furthering the use of OER, there seemed to be various clearly thought-out ideas provided: stakeholders see the need for sharing ideas, material and improving the cultural dialogue about sharing; there is a need for support/guidelines for students and teachers on how to find and use OER material; and lastly establishing a repository where material can be made available.

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Cognitive apprenticeship as a tool for materials development in an EFL teacher education project

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Abstract

A major problem in teacher education is the gap between theory and practice. Engaging student teachers in materials development is one way to integrate theory and practice in EFL (English as a Foreign Language) teacher education. It is during the complex process of materials development that student teachers start to envision learning processes and outcomes of specific language learning tasks. However, materials development does not take care of itself. It is argued that methods of cognitive apprenticeship can be a tool to support student teachers in the complex process of materials development. Cognitive apprenticeship is about modelling and verbalizing the internal cognitive processes underlying complex problem-solving tasks such as adapting authentic materials and writing rubrics. This paper reports how these methods are applied in an EFL teacher education project on materials development. Engaging student teachers in materials development can be a worthwhile opportunity-to-learn in university-based teacher education for any subject whatsoever.

Keywords: Cognitive apprenticeship; EFL; teacher education; materials development.

1. Introduction

Teacher education in Germany is organised in an applied science model in which student teachers are first introduced to theoretical knowledge in literature and cultural studies, applied linguistics and TEFL or subject didactics respectively. This model implies that theoretical knowledge from the first phase of education will "mediate to their teaching practice at some point in the future" (Hüttner & Smit, 2012, p. 165). Yet, as many teacher students and teacher trainees report and experience, the gap is not automatically bridged once they enter school based teacher training. Experiential approaches with "contextualized simulations in which the trainee teachers have to adapt materials for a specific learning context" (Tomlinson & Mashura, 2018, p. 105) can actually help to bridge this gap between theory and practice. However, so far courses in material design and evaluation are scarce in teacher preparations programmes (Garton & Graves, 2014). Materials development is in general a rather neglected area in teacher education and often student teachers are left alone with some "very general guidelines for choosing materials" (Hüttner & Smit, 2012, p 167).

This paper describes one project that attempts to narrow the gap between theory and practice by integrating a materials development module in university-based English as a Foreign Language (EFL) teacher education. In this module student teachers are assigned to select authentic materials (e.g. short films from YouTube) and design tasks for comprehension, analysis and production. It is argued that student teachers need support for this rather complex undertaking. This support is realized by cognitive apprenticeship methods which e.g. model products and scaffold the process of materials development.

2. Materials development and task design in teacher education

Since the mid 1990s there is a growing interest in materials development "both as a field of academic study and as a practical undertaking" (Tomlinson & Mashura, 2018, p. vii). According to Tomlinson (2012) "materials development refers to all the processes made use of by practitioners who produce and/or use materials for language learning" (p. 143). Materials development can result in a "deeper understanding of the individual teaching circumstances surrounding theory and practice"; as student teachers "question and test relevant theory in practice" (Canniveng & Martinez, 2003, p. 480) the quality of reflection is enhanced. In this paper materials development is conceptualized as the whole process from material selection to adaptation and writing rubrics for tasks. The actual process of writing the rubrics for tasks is defined as task design. When practicing materials development student teachers automatically change perspective when designing tasks for learning in the EFL classroom. They anticipate comprehension and production problems, come up with options for material presentation and adaptations. There is common agreement among researchers in the field "that authentic materials can provide meaningful

exposure to language as it is actually used, motivate learners and help them develop a range of communicative competencies and enhance positive attitudes towards the learning of a language" (Tomlinson, 2012, p. 161). In other words it is assumed that student teachers "develop positively as a result of their involvement in materials development" (Tomlinson, 2012, p. 171).

Asking student teachers to be involved in materials development and design tasks for the classroom is a learning opportunity that connects theory-based teacher education with the affordances of professional practice. Hüttner and Smit (2012, p. 167) point out that materials development brings together theoretical knowledge, teacher cognition and teacher experience. Engaging student teachers in materials development is a situated learning experience: In materials development it is essential to think about content, processes and scaffolding that is needed for learners to accomplish the given task in the end and exploit the given material fully in terms of comprehension, vocabulary acquisition and communicative stimulus. However, student teachers are novices in the field and therefore need to be guided along the complex process of materials development and task design in particular.

3. Cognitive apprenticeship

Cognitive apprenticeship (Collins, Brown, & Newman, 1989) offers some opportunities to help students engage in materials development. As Collins, Brown, and Newman (1989) argue, learning contexts in tertiary education differ from an apprenticeship as they often focus on cognitive processes rather than on specific physical actions. While the skills and techniques e.g. of a plumber can be observed, cognitive and metacognitive processes have to be made visible (or audible) before students can reproduce them, which is a prerequisite for receiving corrective feedback.

Collins, Brown, and Newman (1989) outline several methods to foster cognitive and metacognitive learning processes in diverse subject areas (e.g. reading; De La Paz et al., 2016). In the following, we give an overview of the six methods and explain how these methods are used during in an EFL teacher education project.

Modelling: As cognitive processes are internal, the teacher externalizes his heuristics and strategies for problem solving. In our course, we demonstrate the analysis of several materials (e.g. a clip from TV series) and explain the process of classifying materials as suitable or not suitable for the EFL classroom.

Coaching: The teacher observes his students while they carry out a task and offers feedback, hints etc. which aim at "bringing their performance closer to expert performance" (Collins, Brown, & Newman, 1989, p. 481). Such coaching is realized through interactions

that are "immediately related to specific events or problems that arise as the student attempts to carry out the target task" (Collins, Brown, & Newman, 1989, pp. 481-482). In our project, student teachers discuss their ideas while working on a task in pairs while the teachers talk to the groups individually, giving them hints when needed.

Scaffolding: The teacher offers support in the form of suggestions or material support (e.g. cue cards). When the teacher recognizes that a student is not able to solve a certain aspect of a task, the students and the teacher solve problems in a cooperative way. A method that is used in this context is 'fading'. While working on a task scaffolding is reduced gradually by the teacher. In our EFL teacher education project, student teachers receive scaffolding via checklists for analyzing the materials and criteria of selection. A task template is provided in order to help students document the process and keep track of their progress while designing EFL materials.

Articulation: The teacher prompts the students to articulate their thoughts and heuristics. This can be done in a number of ways:

a. by looking at the products of their peers, e.g. by asking the students why a material is suitable,
b. by asking the students to articulate their thoughts while they are solving a task, or
c. by asking the students to act as "critical friend" for each other. In our course, some of the students' tasks are simulated in order to identify possible problems while solving them.

Reflection: When the task (here: materials development) is accomplished and solutions to problems have been found, the teacher and the students reflect upon the process. This can be realized by verbalizing the problem-solving process (e.g. student teachers explain their decisions for adapting and annotating the material) or by referring back to the documentation (here: task template) of the steps undertaken during the entire process of materials development. In our course, the students present their results and explain how they managed to turn an authentic material into an EFL learning resource.

Exploration: In this stage the learner is able to accomplish tasks and solve problems independently. The teacher offers a task/problem the students have to solve on their own. As students are not able to solve tasks without prior knowledge, this method includes presenting exploration strategies to the students. In our course, students choose the materials they want to use as the basis for their materials development after explaining several heuristics for material selection.

4. Description of the project

Our project-based seminar consists of eight interrelated lesson units and aims at achieving two core objectives: in this project,

1) students learn how to select appropriate materials that can be used in the EFL classroom

2) students learn how to design concrete, competence-oriented tasks for use in EFL classrooms

With these objectives in mind, the seminar is structured as shown in table 1.

Table 1. Structure of the seminar

Unit I & II	**Introduction/ Theoretical and methodological foundations** · Introduction to different media formats and genres · Overview over copyright legislations · Analysing the didactic potential of materials for the EFL Classroom **Selection of material** · Selection and didactic evaluation of materials in small groups
Unit III & IV	**From materials to tasks** · Workshop on task design · Concrete advice on chosen materials and planned tasks **Continuation of task design in groups** · Developing competence-based tasks based on chosen material · Documenting the work in progress in form of a task template
Unit V & VI	**Presentation of preliminary results** · Group presentation of results · Feedback based on criteria of task design **Development of final task version**
Unit VII & VIII	**Presentation & discussion of final tasks** · Simulating tasks in class · Presentation of final results · Feedback based on criteria of task design

In the first two units, students are provided with some theoretical and methodological background knowledge. They get to know basic concepts that help them analyse various media formats and genres, and acquire knowledge on copyright legislations. In this early

phase of the project, students gain general input on how to work with materials in the EFL classroom, including thoughts on how to incorporate materials in the school curriculum and on how to offer appropriate scaffolding for using materials in a heterogenous group of learners. Finally, the first two units end with a best-practice demonstration: with the help of an episodes of *How I met your Mother*, students encounter a step-by-step example of the didactic process necessary to prepare authentic materials for use in the EFL classroom.

Equipped with the background knowledge from the first two units, students are then asked to choose their own material. For that matter, they work together in small groups and, within the timespan of roughly three weeks, select a material that fits the curricular standards discussed at the beginning of the project. Once they have found a material, each group writes a short description of it, which is subsequently uploaded on an e-learning platform, so that students can give constructive feedback on each other's choices.

After this phase of researching an appropriate material in small groups, students have the chance to plan and design concrete tasks on their own in unit three and four. To that end, in the form of a workshop, students first learn about the dos and don'ts of task design, different task formats (from analytic to action and production oriented) and different phases (pre-, while-, post-) in which tasks are usually used in the EFL classroom. Then, students once again get together in their groups to start designing their tasks, based on the material they previously selected. In this phase of the project, it is important that the instructors function as 'facilitators' who guide the individual groups in their materials development by providing specific feedback and didactic scaffolding along the way.

In the weeks following unit three and four, students have the chance to keep working on their individual tasks. In this phase, most importantly, the different groups document their work in progress in a task template. Here, students are requested to reflect upon the following aspects:

a. the structure of their material
b. potential problems that might occur when using this material in the classroom
c. the main goals of their individual tasks

Based on these considerations, in unit five and six students are given the opportunity to present the preliminary results of their material analysis in front of the entire class.

Before students present their final task versions in unit seven and eight, they can use the feedback given after the preliminary presentation to revise and edit their original tasks. Then, in the last two units, they present their results again and, more specifically, simulate some of the tasks they created. As such, the presenters temporarily become the teachers and can practice how to guide classroom interactions. After this simulation, the individual groups get feedback from the entire class once again, which helps them to review some

aspects of their tasks one last time. Thus, in the end the project relies on two rounds of feedback that make students aware of the process-nature of task design and allows the instructors to support and comment on the students' work process in several phases.

5. Conclusion

Materials design can be seen as an enrichment of teacher preparation programmes in which participants not only theoretically learn about adaptation of materials but actually adapt the materials. Materials development appears to 'give life' to theory in the language classroom. The experience in our EFL teacher education project disproves the assumption that materials development and task design take care of themselves. Cognitive apprenticeship offers useful methods that can support student teachers when they take their first steps in materials development. Student teachers draw on their theoretical (pedagogical content) knowledge to explain decisions for adapting the material and for designing specific tasks for comprehension, analysis or production. As student teachers explain and reflect upon their strategies, choices and ideas, student teachers are enabled to solve the specific problems which occur during material analysis and subsequent task design. Cognitive apprenticeship thus helps to narrow the gap between theory and practice in university-based teacher education.

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Student Mentoring in the Master Programme "Pedagogy": the case of University of Latvia

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Abstract

There is a developing interest in mentoring and tutoring in the higher education in Latvia. Mentoring is looked at as a retention strategy to support students to remain and continue studies and as a tool to prevent students' drop out from the university. Since academic year 2016/2017 several programmes of tutoring and mentoring in basic studies (bachelor level studies) have been developed and financially supported at the University of Latvia, but so far mentoring has not been used for Master level students. The Master program "Pedagogy" includes a theoretical course "Methods of Mentoring at the Educational Institution". Since academic year 2018/2019 new tasks were introduced for the second year Master students to become peer mentors for the first year students, thus, integrating their theoretical knowledge into the practice, making a closer connection to the 1st year students, by sharing their Master student experience. Data were collected (reflection, portfolios, focus group discussion) both from (14) the 1st year Master students and (14) 2nd year Master students at the end of the course and were analysed qualitatively to reveal the results of peer mentoring experience. The results suggest that both the mentors and the mentees benefited from their involvement in mentoring. The research presents some new benefits and challenges for the professional development of academic staff and student-centred learning in the Master level programme.

Keywords: Peer mentoring, Student-centred learning, Reflection, Quality ensuring.

1. Introduction

In Latvia the rate of students who drop out of the higher education institutions and colleges is rather high. In the academic year 2017/2018, 81.6 thousand students entered 54 higher education institutions – 29 higher education institutions and 25 colleges in Latvia, but the number of students decreased by 43.8 thousand or 35 % (Latvia. Statistics in brief 2018). Student withdrawal remains a concern across higher education sectors world wide for the last few decades (Fourie, 2018, Harvey, Szalkowicz, 2017, Fortin, Sauvé, et.al. 2016). It concerns different programmes and students of different age (Fortin, Sauvé, et.al., 2016, Silver, Jakeman, 2014). As a result researchers and higher education practitioners are looking for ways to support students during their study process. Several strategies can be used for that and they are described in literature. Mentoring, especially peer mentoring, is looked at as a retention strategy to support students to remain and continue their studies and as a tool to prevent students' drop out from the university.

The first part of the paper provides a brief outline of the relevant literature, the second part explains the mentoring experience at the University of Latvia and how the theoretical course "Methods of Mentoring at the Educational Institution" in the Master programme "Pedagogy" was developed to insure the support mechanism for the 1st year Master programme students using peer mentoring. The third part will elaborate on the gathered data. The qualitative analysis reveals the results of the mentoring experience both on the part of the 1st year students and 2nd year students. Finally, there are some conclusions drawn. The paper seeks to answer the question: what are the benefits from the involvement in peer mentoring in Master level programme for both sides - mentors and mentees and what are the challenges?

2. Theoretical background

Factors that can influence the students' decision to leave studies have been determined as those that can be and can not be directly influenced by institutions. Relatively few research on Master level students mention both socio-economic, for example, financial concerns, the distance from the university, student affairs as devalued work, and personal, for example, lack of fulfillment and emotional burdens (Silver, Jakeman, 2014). Perry, Boman et al. (2008) argue that the major reasons for leaving the universities can be placed into two categories, personal reasons and programme reasons. The personal reasons include different life circumstances, work commitments, the programme reasons include the learning style, evolving career aspirations (Perry, Boman et al., 2008). As suggested by Willcoxson, Cotter et al. (2011), the programme reasons concern more students in later years, as withdrawals may be influenced by the quality of interactions with the academic and administrative staff, feedback processes, teaching quality, course advice and university policies and facilities (Willcoxson, Cotter, et al., 2011).

With a better understanding of these factors, it has become possible to choose the specific strategies to reduce the number of leaving students from universities much more purposefully. There are several strategies proposed: related to the course design, course delivery, and programme organisation; there are strategies for the re-integration of students who have withdrawn and subsequently decide to return to studies (Park, Perry, et al., 2011) or for those who are at risk for withdrawing (Harvey, Szalkowicz, 2017). Mentoring and peer mentoring in higher education is consider as one of the cost effective strategies to enhance personal and professional growth among students and to prevent student dropout (Fox, Stevenson, 2006, Terrion, Leonard, 2007). Alongside with the social support (Heirdsfield, Walker, et al., 2008) it provides the psychological and emotional support to mentees (Gunn, Lee, et al., 2016). Mentoring programmes help students to acquire a specific skill for the academic success. It can lead to a greater satisfaction with time allocation at work, higher academic self-efficacy (Feldman, Arean, et.al., 2010). The empirical results suggest that mentoring has a positive effect on the academic performance of mentees (Fox, Stevenson, 2006). The result of such programmes is that both mentors and mentees benefit significantly from their involvement in mentoring. According to Kram (1983) this relationship has the potential to enhance career development and psyhosocial development of both individuals. Terrion and Leonard (2007), enhanced Kram's (1983) mentoring model, by developing a taxonomy of five prerequisites for the student peer mentor, two student peer mentor characteristics that support the career-related function and eight characteristics that support the psychosocial function (Terrion, Leonard, 2007). Later research has indicated psychosocial assistance, networking help, and relational outcomes as an important outcome reported most among participants after participating in a peer mentoring programme (Fleck, Mullins, 2012). Despite benefits reported by many previous studies, peer mentoring can have some challenges too, sometimes it is a far from the perfectly harmonious process between mentors and mentees (Lim, MacLeod, et al., 2017) and it can bring some frustration of mentors (Heirdsfield, Walker, et al., 2008). Therefore, as it is stressed by Terrion and Leonard (2007), there are some prerequisites for the student peer mentoring: the ability and willingness to commit time, gender and race maching, the same university experience, the academic achievement of the mentor, prior mentee experience (Terrion, Leonard, 2007). However, the findings differ on how important it is to prepare mentors prior to mentoring. There is research suggesting that it is not such an essential mentor program characisctic (Fleck, Mullins, 2012), at the same time other research insists that preparation or induction for mentoring is an important part of successful mentoring (Heirdsfield, Walker, et al., 2008). Findings of Gunn, Lee, et.al. (2017) have concluded that potential peer mentors should participate in structured orientation sessions, so that mentors would feel comfortable with (a) assisting mentees with academic, social, and personal challenges, (b) role modelling, (c) sharing academic and social experiences and challenges, (d) connecting mentees to campus

resources, and (e) helping mentees develop academic skills in order to be more successful at the university level (Gunn, Lee, et al., 2017, 23).

3. Empirical study

3.1. Mentoring experience at the University of Latvia

Since academic year 2016/2017 several programmes of tutoring and mentoring in basic studies (bachelor level studies) have been developed and financially supported at the University of Latvia. University of Latvia applies several actions according to "The Standards and Guidelines for Quality Assurance in the European Higher Education Area" (2015) to support all phases of the student "life cycle" from student admission, development and graduation. Up to now mentoring has not been used for Master level students. The Master programme "Pedagogy" includes a theoretical course "Methods of Mentoring at the Educational Institution". Until this year it was taught to 2nd year students and the course was mostly related to developing students' understanding of the essence of mentors' activities, their functioning in different educational settings, especially mentors for novice teachers in schools. Since academic year 2018/2019 new tasks were introduced for 14 second year Master students to become mentors for 14 first year students, thus integrating their theoretical knowledge into the practice, making closer connection to the 1st year students, by sharing their master student experience. Only a part of the Master programme students has studied previously at the University of Latvia on their bachelor level; the majority have their bachelor education in pedagogy, the rest – in other branches of science (e.g., philology, art, politology, economics, history, theology). All students are employed. Six student families in the 2nd year and seven families in the 1st year have preschool and/or school age children.

During the first two autumn semester months (September – October) in the frame of the course 2nd year students acquired theoretically the basics of mentoring, chose the 1st year student for mentoring, found out the needs of the mentee, developed the action plan of mentoring and started the mentoring of the 1st year students. It was the first experience for the majority of students. Two of the 2nd year Master programme students had already had some prior experience.

3.2. Data collection and results

Firstly, peer mentoring data have been collected by distributing self-report surveys and, secondly, facilitating a focus group disscussion. Data obtained during the research were analysed qualitatively to reveal the results of the peer mentoring experience. Responses were analysed according to the principles of thematic analysis, first dividing the units of the content of the answers, then grouping them into sub-topics and closing the categories at the end.

Results revealed four aspects that caused different challenges to both mentors and mentees - the physical environment of the faculty; the experience of students' previous education; students' employment and the family status. The faculty changed its location in academic year 2018/2019, thus, in general the physical environment of the faculty was unknown to both the mentors and mentees.

There were some attitude problems at the beginning from mentors side. Initially, two of the 2nd year students coming from another higher education institution had a rather sceptical attitude to their role as the mentor of the 1st year students. One of them wrote: "*I feel mentoring as a partly imposed activity that creates unnecessary stress, opposition.*" The other, in her turn, wrote: "*My mentee is knowledgeable, also confident, sure of her abilities; she is able to cope herself with everything. I can't imagine how I can be of help to her.*" Both these mentors also pointed out that they had studied at another university. Yet, the mentors' doubts diminished as soon as they got acquainted with their mentees and had explored their needs. One mentor writes: "*At the beginning I was worried when the mentee announced that she did not see any point in all this. However, reading the needs questionnaire filled by this student I understood that it would be useful for her to find out the academic staff of the Master programme, the available resources, e-studies, the writing of the Master's paper.*"

Most of mentors even at the initial stage of mentoring are aware that there are several benefits in the mentor's work; it also gives possibilities for acquiring additional skills. This aspect that mentoring serves as a possibility for gaining valuable experience for both sides has been also stressed by mentees. A mentor writes: "*Although the mentee's needs and development is in the centre, both should be winners.*" Other mentors, too, indicate that they will need "*responsibility, leadership skills, the willingness to help in their mentoring of the 1st year students*". Common professional and research interests that encourage both the sides to mutual exchange of experience are significant in the initial cooperation of the mentor and the mentee.

From the mentees side, at first, mentees expect the mentor to be responsive, to help to solve issues related to university life, to share the personal experience: "*To my mind, if the person tells something from her personal experience, it creates the sense of safety and the conviction that I also can do it.*"

The analysis of the results of the focus group discussion allowed concluding that no contradicitions were found in the answers given by mentors and mentees. The most important benefit from the implemented mentoring has been the consultative support provided by mentors regarding the programme – the choice of the research theme, facilitation of a better understanding of the content and organization of the studies. The mentor's support has been especially important for those students who had not previously studied at the University of Latvia when getting familiar with the e-learning system as well as students who had not

studied pedagogy before. The obstacles in the face-to-face communication mentioned both by the mentors and mentees have been being busy at work and difficulties in finding common time for cooperation.

Mentors admitted in the focus group discussion that they themselves as mentors had had to learn much, to acquire both the knowledge and skills. Two mentors emphasized especially that in case of uncertainy they had had to search for information reading articles about the mentoring experience of other mentors. Mentors had observed the behaviour of other people, have mastered the skill to listen, to provide the feedback, to reflect on what they had seen and heard. Mentors had understood that the key skills in mentoring were the skill to set the boundaries, confidentiality, "not intruding" too much with their help as well as it was important for the mentors to be aware of their own emotional resources and personal competence. According to mentees, their biggest challenges had been the lack of self-discipline and the skill of planning their time.

Both mentors and mentees pointed to the emotional support that they had given or received. Mentors stressed that the fact that you had been in a similar situation as the mentee had helped in mentoring.

Mentors also concluded that mentees were mainly suppressed by everyday things, issues at their work, care for the family while the issues related to the studies had mainly been easily understandable, easily solved. Mentees had found the advice, concerning requirements that had to be observed studying with each lecturer of the programme, useful.

All in all, the implemented mentoring can be assessed as a positive experience for all those involved who continue studying in this programme. However, during the programme two 1st year students did not pass the examinations of the first semester and did not continue their studies due to reasons that were not connected with the university. Yet, owing to the mentoring programme, it is known why they dropped out from their studies and that the reason can not be directly influenced by the higher education institution: one of the students cannot combine studies with the load at work and the necessity of choose work as the priority to provide financially for oneself; the other student discontinued studying due to her children's prolonged illness.

4. Conclusion

The mentoring relationship can lead to different outcomes because of its multifaceted nature. This research provides insights into mentors and mentees' experiences in the Master programme "Pedagogy" during the course "Methods of Mentoring at the Educational Institution". The introduction of peer – mentoring in the Master programme does not allow fully avoiding the student drop out, where the reasons are not directly connected to and

influenced by the educational institution, but it is better understood thanks to mentoring. However, mentoring provides support in the acquisition of the programme and in coping with different personal aspects. During mentoring mentors and mentees experienced several benefits, both related to the programme and personal aspects, such as the given consultative support in relation to the programme and research – the choice of the research theme, facilitation of a better understanding of the content and organization of the studies. Mentors admitted that they hadmastered leadership skills while mentees, in their turn, acknowledged that they had gained socioemotional support. It coincides with Heirdsfield, Walker, et al. (2008). It is especially important for those students who had studied in another higher education institution or faculty before, or had received their bachelor degree several years ago, or had studied in other than pedagogy programmes. Mentors experienced several challenges throughout the mentoring experience: the physical environment of the faculty; the experience of students' previous education; students' employment and the family status.

Overall, the positive experience suggest, that the mentoring should be continued and probably made an institution-wide approach (Nelson, Smith, Clarke, 2012) not only for the experience of the 1st year students, but for the Master programme students, too.

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An exploratory study of early career teachers as culturally responsive teachers

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Abstract

The purpose of this study was to advance understanding on how early career teachers imagined themselves to be culturally responsive and how their beliefs and ideologies about teaching a diverse range of learners were challenged and refined during their early years of teaching. This qualitative, exploratory study was conducted in a large, secondary school in eastern Australia that has a highly diverse population of students. Findings indicate that, while these early career teachers lacked preparation for working with diverse learners, building relationships on multiple levels (with students, with fellow beginning teachers, and with senior staff which includes ongoing support and mentoring from colleagues) is essential for the development of early career teachers as culturally responsive practitioners. Findings are discussed in relation to Garmon's (2005) six key factors for teaching diverse groups of students: openness, self-awareness, commitment to social justice, having intercultural experiences, have support group experiences, and recognising individual growth. These findings have implications for schooling systems in how they can better transition early career teachers to classrooms and for higher education teacher preparation programs in Australia and many other countries with a growing number migrant and refugee students coming into the school system.

Keywords: culturally responsive teaching; early career teachers; cultural diversity.

1. Introduction

The diversity of the Australian population has broadened considerably over the past decade. According to the most recent census data (Australian Bureau of Statistics, 2017), approximately one third of people currently living in Australia were born overseas and approximately 21% of the Australian population speak a language other than English at home. Over one half of this immigrant population reside in the state of Queensland, the context for this study. Along with this changing demographic, school classrooms have experienced a similar shift with a large increase in diversity in their student populations. Teachers are now required to be inclusive educators who cater for the ever increasing diverse needs of learners in their classrooms. However, there is evidence that some teachers have received little or inadequate training to work with diverse learners or may perceive that they do not have the capabilities to do so (Kaikkonen, 2010; Kraska & Boyle, 2014; Rose, 2010). These teachers, as a consequence, see too many barriers to their engaging effectively with diverse learners which, in turn hinders their approach to working with diverse groups of students. Teachers with positive attitudes about inclusive education are more willing to accept diversity allowing students who may be marginalised greater opportunities to participate and gain membership in the class. While much literature in the area of teaching diversity has focused on the learning needs of students, the focus in this paper considers the perceptions of teachers who are working with culturally diverse learners. In particular we consider the perceptions early career teachers have of their themselves as culturally responsive teachers (Gay, 2010) through the various relationships they cultivate in their teaching practice. It is important to understand early career teachers' perspectives as they are at the beginning stages of their career, they are positioning themselves in their profession as culturally responsive practitioners.

2. Culturally responsive teaching

Being a culturally responsive teacher is a fundamental component of being an inclusive educator. According to Gay (2010) culturally responsive teaching involves teachers making use of students' cultural knowledge, prior learning, prior experiences and performance styles to make learning more relevant and effective. Teachers must be willing to adapt curriculum to be culturally relevant for their students, demonstrate and create a culture of caring for all students in their classroom, have some knowledge and/or experience of cross-cultural communication or be willing to develop these skills, and use culturally congruent instructional practices. The concept of culturally responsive teaching goes beyond employing ethnically tokenistic inclusive practices.

Siwatu (2011) and Bodur (2016) suggest that, if teachers are to develop as culturally responsive practitioners, then more explicit description of culturally responsive teaching

needs to be embedded in teacher education programs. While completing coursework assignments provides preservice teachers with good background information for considering the process of teaching culturally diverse students, first-hand experiences provide a greater understanding of how the process is enacted. It is therefore proposed that preservice teachers need to be exposed to culturally diverse classrooms in their professional experience placements in schools throughout their teacher education programs. Garmon's (2005) research identified six key factors needed in preparing preservice teachers to become culturally responsive teachers. These key factors include openness (being receptive to others' ideas and to diversity), self-awareness (being self-reflective to gain insight and understanding of one's beliefs and attitudes about diversity and how these influence one's approach to teaching), commitment to social justice (involves the notion of equity and equality for all people in a society), having intercultural experiences (opportunities for direct contact with different cultural groups), having support group experiences (with peers, supervising teachers, lecturers, family, friends etc.) and encouraging an individual's growth in thinking more deeply about diversity, and educational experiences (in coursework and practicum) that contribute to changes in beliefs/attitudes about diversity. Building these six factors into teacher education supports the notion of building relationships on multiple levels as essential for effective teaching with diverse groups of students.

Teachers locate themselves in relation to the diversity of their students (Cummins, 2015). This self-positioning shapes not only their teacher practices but the interest and ability of their students to learn. While it is important to build relationships on multiple levels, it also needs to be acknowledged that in every classroom there is a power relationship that influences the teacher's role. One kind of power imbalance occurs when the teacher holds negative views about the non-dominant cultural groups of students in their class. When teachers create an environment of collaboration of power relationships by students having their identities affirmed, students are more likely to be positively engaged in learning. Hagenaur, Hascher and Volet (2015) found that student engagement is a significant predictor of teachers' emotional experiences in the class. Positive engagement creates feelings of joy about teaching while negative engagement results in teachers feeling anxious and angry. Teachers must recognise not only that their students have culturally legacies but that *they too* have cultural legacies that influence classroom interactions (Walter, 2018). Therefore, teachers must be aware of any personal cultural biases that they might bring into the classroom. Teachers' positive approaches to teaching can influence students and result in students experiencing positive emotions and feelings of well-being in relation to participating in class. The purpose of this qualitative study was to explore how early career teachers' beliefs and ideologies about teaching a diverse range of student learners were challenged and refined during their early years of teaching and to identify how early carrer teachers were supported in adapting to teaching culturally diverse students.

3. Method

This qualitative study was conducted in a large school (n~2300 students) in a low socio-economic area of south-east Queensland, Australia. The school has a highly diverse population that includes students with Anglo-European backgrounds, students with backgrounds from the Pacific Islands (e.g. Samoa, Tonga), Maori students from New Zealand, students with Asian backgrounds (e.g. Chinese, Vietnamese) and approximately 8-10% of the students who identify as Indigenous Australians. Thirty-three percent (33%) of students at the school speak English as an additional language or dialect (EALD). Each year, the school accepts large numbers of preservice teachers for practicum. Over the years, a significant number of these preservice teachers have been employed by the school as early career teachers. The research reported on in this paper was conducted with a group of these early career teachers.

Our overarching research question was: how are early career teachers' beliefs and ideologies about teaching a diverse range of student learners challenged and refined during their early years of teaching? Our research sub-question was: How are early career teachers supported in adapting to teaching culturally diverse students?

3.1. Participants

The participants in this study were six early career teachers at the school. Three of the teachers were in their first year of teaching and three were in the second year of teaching. All six teachers had completed a professional experience placement at the school prior to graduation and their subsequent employment. One teacher (female) was in the Special Education unit working with students with learning difficulties, one teacher was in a special English-as-an-additional language or dialect (EALD) unit, one teacher was a manual arts teacher; the other three teachers taught science and mathematics. All the teachers were born in Australia and were from Anglo-European backgrounds, which is fairly representative of teacher demographics in Australian schools.

3.2. Data collection and analysis

Ethical clearance and permission to conduct the study was received from the relevant university ethics committee and from the school. Data were collected via individual semi-structured interviews with each of the six teachers at the school site. Interview questions included: What experiences prior to starting at the school did you have of working with divserity? How have your experiences at the school shaped your beliefs and understandings of diversity? And how are you supported in eaching to the diversity of students in your classrooms? Each interview was approximately 30-40 minutes long. The interviews were audiorecorded and pseudonyms were used in the transcriptions to maintain anonymity and confidentiality. The data were analysed deductively (Saldana, 2015) by the researchers using

principles of thematic analysis. Garmon's (2005) six key factors for teaching culturally diverse learners: openness, self-awareness, commitment to social justice, having intercultural experiences, have support group experiences, and recognising individual growth were used as an analytic framework for examining early career teachers' developing selves as inclusive educators.

4. Results and Discussion

This research explored beginning teachers' developing teacher identity as culturally responsive educators. Findings indicated that building relationships on multiple levels (with students, with fellow beginning teachers, with senior staff and mentors) was essential for their development. In relation to Garmon's (2005) six key factors contributing to the development of culturally responsive teachers, all participants expressed an openness and a positive self-awareness in relation to teaching diverse learners and how their various, prior experiences helped to shape and influence their approaches to teaching diverse groups of learners.

Having been brought up in a diverse suburb and family, I have developed understanding of diversity through family (Participant 3, male, first-year teacher).

And from another

My own upbringing did not expose me to much diversity. However, I have done a lot of travelling, spent time in many countries and with people from many cultures and backgrounds. I enjoy learning things from and about different people and can see how different experiences shaped my view on things (Participant 2, female, second-year teaching).

Many of the participants described how they had purposely selected to do their final Professional Experience placement (practicum) at this particular school primarily to gain experience in working with diverse groups of learners. These proactive choices (Cummins, 2015) set the scene for a willingness of these teachers to learn how to develop positive teacher-student relationships which would, in turn, allow for a greater sense of empowerment for them and their students in the learning environment. The sentiment expressed in terms such as "be open and accepting", "keeping an open mind" was conveyed by all the participants as the necessary foundation for their teaching.

Each of the participants described a strong commitment to social justice (Garmon, 2005) and worked with a focus to create learning opportunities that fit best with individuals in the groups of students they taught as well as for the whole class. They were encouraged by the '…small wins' and having '…realistic expectations' to keep students engaged over time toward gaining a larger sense of accomplishment. Developing positive relationships with students was the one way to realise these small wins. The teachers had some knowledge of

and took consideration of their students' home lives in their personal relationships with them and in their curriculum planning. Differentiating the curriculum to fit the learning needs of students was described by each of the participants. While having a focus on the Australian curriculum that needed to be taught they adapted the curriculum to include students' cultural and individual needs. One participant, for example, described trying to embed Indigenous perspectives into the science curriculum which had the opposite effect than intended. Instead of being engaged students were disruptive in class. This student response perplexed the teacher as a requirement of the Australian curriculum and his teacher education indicated that he should embed Indigenous persepectives. Upon discussing the lack of student response with senior staff and his students, the teacher came to realise that while there were a few Indigenous students in his class, there were a greater number of students from other cultures, primarily South-sea Islander students whose culture he was not embedding in his lessons. This reflection and subsequent self-awareness (Garmon, 2005) on the part of the teacher led to him change his teaching approach to embed not only Indigenous perspectives but perspectives from the other cultures in his lessons with the outcome that students became more receptive and responsive to his teaching. This engagement, in turn, created a sense of well-being in this teacher that he was making positive connections with students and promoting their learning. This change in emotional engagement aligns with Hagenaur et al.'s (2015) suggestion that enjoyment is contagious in a classroom. If the students are happy with the process of learning, the teacher feels happy with the process of teaching. Adapting curriculum to fit in with students' culture is one way to give students a voice in the class. Through this voice they feel that their culture is acknowledged and respected. The participants saw themselves as significant partners in their learning.

Vital to the participants' sense of identity as culturally responsive teachers were the collegial relationships with other staff at the school. Being the junior staff members the participants felt well supported by colleagues. There were many professional development opportunities to learn about diversity, a mentor from senior staff was assigned to each of the participants, they were allowed time in their schedules to go into other classrooms and observe the strategies that other teachers used, and there were continuous conversations with fellow teachers about best practices for working with students. These beginning teachers were encouraged to believe that mistakes they made were learning opportunities and to take this idea as a reality and not simply an old adage that they had heard before. Being in an environment that took a whole-school approach to diversity and social justice participants described how they never felt a sense of isolation in their work nor that they had to work things out for themselves. There were a number of people they could call on to discuss problems that arose or to talk through what strategies might be the best to use with a certain group of students. This kind of support aligns with the notion of using 'roadmaps' as described by Oyserman et al. (2004) where the participants were striving to become the best teacher they could be, using the ideas and modelled behaviours of others but having the final

say of what would work best for them in their own classroom. These positive examples and support created a high sense of agency in these beginning teachers which allowed them to feel comfortable in taking risks in trying new strategies in the classroom (Hagenaur et al., 2015).

In describing their journey to becoming culturally responsive teachers, the participants in our study described that they received little in their teacher education course that prepared them for working with diverse learners. As two participants described it:

There's not much that I've learnt through the contact time with the university that I've put in place…here, even the curriculum planning units that I thought would be really useful…but how we curriculum plan our units here is completely different (Participant 5, female, second-year teacher).

What they described aligns with other research in the area (Miller & Shifflet, 2016; Feiman-Nemser, 2001) that preservice teachers need real world contact and scenarios where they are encouraged to reflect more deeply on what it means to become a teacher and how to go about this. Without this connection to actual working scenarios preservice teachers must rely on their memories and ill-formed ideas of teaching. Preservice teachers need opportunities to understand what it means to be a culturally responsive teacher and how to enact being one. This is particularly important today in Australia and many other countries with the growing number migrant and refugee students coming into the school system.

5. Conclusion

The world continues to experience an increasing mobility of people from one country to another due to a range of global issues. Australia, like other countries has welcomed many migrants to come and settle into new lives. This study indicates that schools, like the one we describe, are transforming the way they approach teaching and learning. They have made the decision that all teachers need to understand how to work with a diverse range of learners and this is particularly important for their beginning teachers. These new recruits are starting off their teaching careers deeply embedded in a school ethos that celebrates diversity, not as a single day of recognition or with lip-service to the idea of diversity but with concrete, everyday hands-on teaching and learning. Immersion in such an environment can only result in these beginning teachers developing identities as culturally competent teachers. However, the study has highlighted that, in addition to better preparation in their preservice teacher education programs, teachers need ongoing support and mentoring from their teaching colleagues in their early years of teaching to best serve the needs of the diversity of learners in twenty first century classrooms.

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A platform for the influencers: spreading educational innovations via a professional learning network

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Abstract

To further the spread of educational innovation and the sharing of good teaching practices our faculty decided to set up a professional learning network (PLN). With the PLN the aim is to reach an early majority of lecturers by asking influential lecturers to share their practical experiences.

Via the PLN meetings for lecturers are organized, web-based resources are made available and educational support is provided. In meetings lecturers present good practices for their colleagues. The topics of the meetings connect to faculty policy (such as: technology enhanced learning, inclusion of international students).

Analysis of visitors to the meetings shows the target audience has been reached. Visitors are mainly lecturers, associate professors and professors, spread evenly across all departments of the faculty. On the topic of Technology Enhanced Learning, 71% of the visitors to the PLN are outside a group of early adopters. Overall, meeting visitors are found to be innovators, early adoptors and early majority.

In conclusion we found that a PLN can be used as a platform for influencers to reach an early majority of lecturers.

Keywords: diffusion of innovation; technology adoption; staff development; professional learning networks; university education.

1. Introduction

Changes in the higher education landscape forces faculties and it's lecturers to change their approaches to teaching and learning. These changes stem from global developments (globalization, digital transformations) and from advances in research about teaching and learning. As an example, active learning style courses, where students work through a blend of face-to-face and online activities, are proving more effective than a more traditional lecture-and-exam style of course. A meta-analysis (Freeman et. al., 2016) comparing 225 studies under traditional lecturing versus active learning showed examination scores to be 6% higher in active learning courses as compared to traditional lecturing courses. Also, students in traditional lecturing courses were 1.5 times more likely to fail than in courses with active learning. Within the faculty of Economics and Business the need is felt to make this message heard.

Not every lecturer and every class needs the same innovations. Innovations concern not only tools to support active learning but also other topics concerning the faculty's educational policy: inclusion of international students, research driven education, employability, and learning communities. How can we spread these ideas and support implementation by higher education lecturers?

1.1. Reaching the early majority of lecturers

Theory on diffusion of innovation (Rogers, 1962) describes a chasm. This chasm can be seen in Figure 1. Early adopters are eager to take up innovations, but it is hard to move from the early adopters to a the early majority. Moore's work (1999) on crossing this chasm taught us to work the curve from left to right. Each group of lecturers within a faculty has its own characteristics and thus needs a different communication approach to win them over for an innovation. Innovators may see innovation as a way to dramatically change things and are willing to take huge risk to do so. For reaching the early majority, a different, more pragmatic approach is needed. For this group the focus should be on solving practical problems that are proven to work.
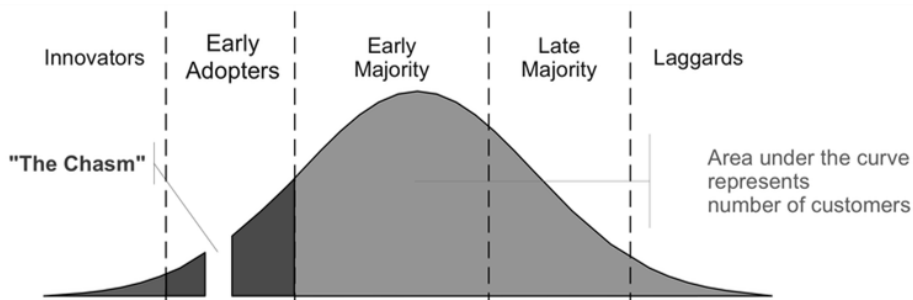
Figure 1. Technology Adoption Lifecycle (Image: Craig Chelius, creative commons, CC-BY-3.0).

1.2. Professional learning networks to spread innovation

In education, professional learning networks (PLN) are seen as promising to work this curve. Early adopters can describe what practical problems were solved for their courses, thereby supporting the early majority. The influencers are lecturers from the group of early adopters who are willing to show how innovations made a practical difference within their courses. Influencers take risks and experiment, the early majority is interested in payoff for their courses in terms of time investment or effectiveness of student learning. Thus for a PLN it makes sense to ask influencers to present and share their experiences in the network.

The characteristics of a PLN (Stoll et. al., 2006) can be used to it's design. The faculty board should support the PLN. Learning in the community should be collective and put in practice. Practices of lecturers are shared, discussed and reflected. To support this and make the PLN sustainable supportive conditions are needed (Smith, 2012), such as recognition of the time needed to make changes to courses, contextualised innovation (thus: practical examples of peer lecturers), supportive networks, and a solid institutional infrastructure.

The model for a PLN should be highly social and informal. A study by Dancy et. al. (2016) on the use and spread of peer instruction shows that social interaction amongst staff is an important communication channel. The PLN should use the power of these informal networks. It is an important lesson to add informal networks to traditionally employed staff training programs such as advocated by Guskey (1984). Besides training sessions, papers and websites informal means should be employed: network building through social activities such as, workplace learning and coaching.

To put this ideas into practice we'd like to know what audience can be reached with a PLN. With reaching the intended audience, can we indeed see that "influencers" help to reach an early majority? Thus, questions for this study are:

- Which population of teaching staff can be reached with a PLN?
- Can a PLN be used to reach the early majority of teaching staff?

2. Design of a PLN: FEBcon

In a memo to the faculty board the plans for the network were outlined. Time slots and a planning for the network were set, with meetings four times a year, plus a social event afterwards. Planning of the meetings was in exam weeks, so the lecturers had no classes to teach. We've set the maximum meeting time to an hour. Speakers were asked to keep it short and focus (what problem did it solve, how did you solve this, what were student responses, what would you recommend to colleagues). Further, we asked for hands-on activities, not just presentations. A steering group was made consisting of two educationalists and the professor of educational innovation of the faculty. This group set the

topics and invited lecturers from their own faculty contacts. Further, a website was set up and promotional videos were made. FEBcon, our PLN, was born.

Figure 2. FEBcon participants in a meeting on design thinking.

As described in literature (Smith, 2012), many of the enabling factors were now in place. Support from the faculty board was achieved. Lecturers were invited who discussed how innovation worked in their course (contextualized innovation). The faculty infrastructure in terms of locations, funding and organization support was used. Recognition of time needed to change practices depends on the particular context of the course (does the time required fit in allotted time for course design?). To help with allotted time, some lecturers were able to take part in faculty or university innovation projects.

3. Study design

To answer the first question we analyzed the characteristics (position, department) of the visitors to the FEBcon meetings. We'd like to see if there is a spread across different positions (lecturer, associate professor, professor) and departments of the faculty. Looking at demographics could give information regarding the effectiveness of the network.

To answer the second research question we selected one educational innovation project from within the faculty, called Technology Enhanced Learning (TEL). The electronic learning environments of courses were looked into for examples of use of TEL. This gave

the list of early adopters, actually using TEL within the faculty. Comparing this list to to the visitors of FEBcon helps to answer the question which audience is reached.

To see whether the PLN reaches the early majority, the group of visitors of FEBcon was scored according to the stages of the adoption life cycle (Figure 1). This was done in a small group of three experts, and based on several data sources.

4. Analysis

4.1. Which population is reached with a PLN?

Three network meetings held so far resulted in a total of 68 unique visitors (out of a total of 467 staff members). Table 1 shows spread over faculty departments.

Table 1. Spread of FEBcon visitors over faculty departments

Department	FEBcon visitors	Department total
Accounting	8	35
Economics, Econometrics and Finance	14	135
Innovation Managent and Strategy	16	41
Global Economics and Management	9	70
HRM and Organisational Behaviour	3	37
Operations	7	65
Accountancy	1	27
Marketing	4	39
Education support (plus trainers)	6	18
Total	**68**	**467**

Figure 3 shows groups of visitors divided over their job function, compared to the number of staff with this function in the overall faculty population.
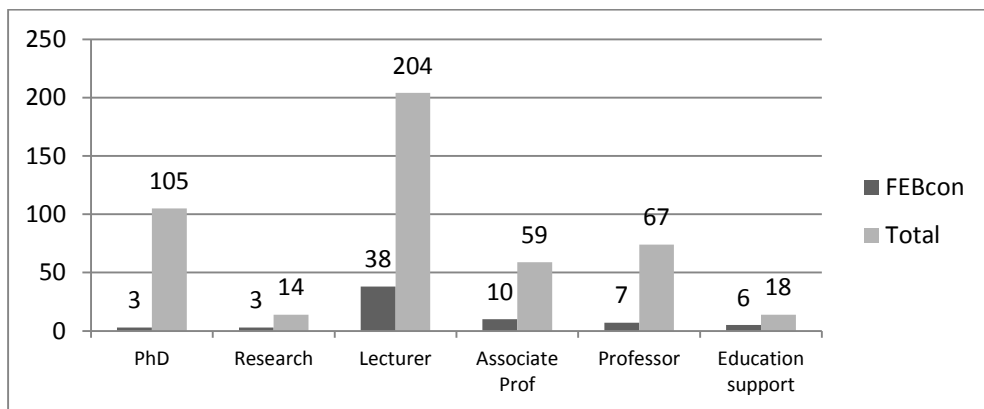
Figure 3. FEBcon visitors related to their function.

To give an overview of courses that employed TEL tools, a total of 229 course environments were studied, with courses running in the first semester of the academic year 2018-2019. Examples of TEL tools used are: weblectures, online annotation, digital books, personalised maths learning, peer feedback, games and simulations. This gave a list of early adopters in the use of TEL tools. In this list all involved lecturers of the course are included, as it is assumed the use of the these tools is discussed with all lecturers in the course. The list was compared to the visitors of FEBcon. Out of the FEBcon visitors, 20 lecturers were on the list of courses using TEL (29%). Thus, 71 % of the visitors to FEBcon are in a group outside of these early adopters.

4.2. Can a PLN be used to reach the early majority?

To answer the second research question, the visitors to FEBcon were analyzed by an expert group and scored along their stage in the adoption cycle. This gave a distribution as shown in Figure 4.
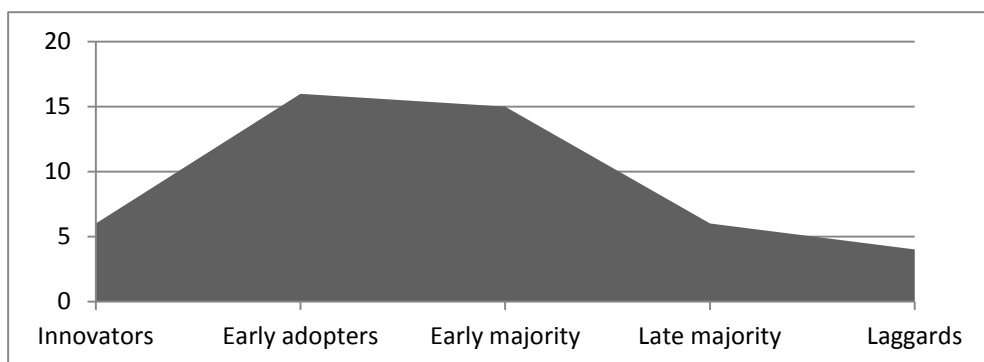
Figure 4. FEBcon visitors characterised according to stages in the technology development cycle.

Figure 4 thus gives an estimate of the composition of groups that were present during the first 3 meetings of FEBcon.

5. Conclusions and discussion

In this study two main questions were asked. We wanted to know which population of teaching staff can be reached with a PLN, and if a PLN can be used to reach an early majority.

First off, to make setting up a PLN work, some premises needed to be in place, a network to promote meetings, faculty contacts to find speakers and current topics, and support from the faculty board. This enabled the design of our PLN (FEBcon).

With three network meetings held and 68 unique visitors the composition of this audience seems to be as intended. Visitors to the network meetings are spread evenly across departments, and a spread is found over lecturers, associate professors and professors. The amount of visiting educational support staff, PhD's and researchers is relatively low, as was intended. So, the potential for social and informal contacts as stressed by Dancy et. al. (2016) is there.

In terms of attendance of these events, there is still a way ahead of us. Reaching 68 out of 467 teaching staff are in absolute terms not high numbers. But, compared to similar staff development events at university level attendance is good. A generic, university level education day attracts about a hundred lecturers, with a maximum of 10 lecturers from our faculty.

Analysis of data shows a network of lecturers has potential to reach an early majority of lecturers. We compared an overview of lecturers who have implemented TEL in their own courses with the FEBcon visitors. This shows that we are reaching most groups of lecturers, not just the early adopters, with 71% of visitors of FEBcon not on the list employing TEL. Our network entails more topics, but we see this as an example of the potential of the network.

Analysis of where the visitors are in the technology adoption cycle gives a slant to the left side of the figure. Relating back to the work of Moore (1999) the approach in our PLN has been most attractive to innovators, early adopters and early majority. This means that in order to reach the early majority we could tailor our approach even more towards this group. It could also be a lesson for staff development meetings elsewhere. If you want to attract early majority: tailor your message to make it practical and use proven examples. Early and late majority of lecturers do not want to take risks and spend time to pilot. Ask lecturers from the early adopters to discuss their own problems and solutions, thus sharing

their lessons learned. These lecturers are the influencers that are likely to draw in the early majority.

So it seems we have reached our intended audience. But what happens next? Alarmingly, a study by Henderson et. al. (2012) amongst 722 US lecturers showed one third of lecturers leaving the innovation process at some point. This sounds like an incredible waste of resources and energy. Possibly, a propagation model for innovations (Froyd et. al., 2017) may turn out more effective than dissemination models. Reaching lecturers is one thing, adaptation, improvement and learning why things work is a second. Propagation is about development of a strong product through engagement with adopters, and understanding of their instructional systems. Further study of where and why lecturers leave the innovation process and how succesfull innovations are propagated is needed. This to ensure that the best use is made of the lecturers' enthusiasm, time and efforts into quality education.

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Teaching4Learning@UNIPD to promote faculty development at the University of Padua, Italy: the experience of the Agriculture and Veterinary Medicine School

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Abstract

Teaching4Learning@UNIPD started in 2016, and it representes the first step for the University of Padua to foster innovative teaching in response to European recommendations. It encourages faculty to experiment with new teaching strategies; involves students and promotes their active participation in educational activities; de-privatizes teaching; and has progressively increased the number of faculty learning communities. It was initiated by faculty who self-selected to participate and who had a significant inclination to enhance their approach to teaching and learning. The School of Agriculture and Veterinary Medicine joined the T4L@UNIPD programme organizing a first level course and is currently participating in a second level course promoted by UNIPD and aimed at training 30 selected professors (among them, 9 from the AMV School) in order to promote teaching and innovation within their Departments. The study of several differents strategies, tools and actions were included in the course and their application in teaching are now in progress.

Keywords: Faculty promotion project;Active learning; Learning community; new teaching strategies.

1. Introduction

The Teaching4Learning@UNIPD (T4L@UNIPD) programme began in the 2016/2017 academic year, as a consequence of findings of a national funded project called Employability & Competences (Fedeli et. al. 2017, Fedeli, 2016), with the aim of promoting teaching innovation at the University of Padua, Italy. It represented the first step for the University to foster innovative teaching in response to European recommendations (European Commission 2011; 2013). Each of the departments involved implemented a faculty development programme based on the needs of its instructors. The goal was to introduce interactive teaching practices reflecting a model or an "Italian way" based on the contemporary research of effective practices for student teaching and learning. The aim is to develop a mix methods research design (Creamer, 2018) by listening to the students' voices, better understanding their thoughts on teaching and enhancing ways in which faculty teach. Instructors experiment and discover together new teaching strategies to involve students and encourage them to participate actively in educational activities; slowly de-privatizing their teaching (Adam & Mix, 2014); and progressively increasing the number of faculty learning communities through the involvement of other interested colleagues. All the instructors involved were self-selected, strongly interested and motivated to participate, with a significant inclination to share their teaching experience. As this programme was implemented, it became apparent that equal attention had to be given to organizational change and to the training of individual faculty innovative teaching practices. This meant putting teaching and learning at the centre of reflective discussions and creating a culture for change. Since 2016, more than 400 faculty members of UNIPD have participated in the faculty development programme. Anecdotal responses by faculty on the training were collected and a constant among these responses has been that most faculty found the training impactful. However, despite the enthusiasm for the programme, there was also a general sense that new teaching practices would be difficult to implement, particularly with regard to the institutional emphasis on covering content, i.e. a passive transmission teaching model, and on formal examinations. The challenge of supporting faculty in this process involves identifying the related implications of fostering innovative teaching and learning and the role the organization/institutional culture plays in the development process. Historically, the Italian higher education context is characterized by minimum attention to teachers' teaching activities, and by exceptionally high attention to research activities, which reflects on how career progression is implemented. Furthermore, it becomes important, in this context, to underline how the long tradition of lecturing as the preponderant didactic form and the lack of attention to the interaction and the involvement of students has made the promotion of didactic innovation very difficult. Especially within a university that is almost 800 years old such as UNIPD.

2. T4L@UNIPD: the experience of the Agriculture and Veterinary Medicine School

The University of Padua is organized in departments, mainly involved in research activities, and schools which coordinate the teaching activities. The departments of the University of Padua are 32, the schools are 8, while the total number of professors is 2.200 for a number of student of about 60.000.

Among the 8 schools, one is located in Agripolis Campus and is the School of Agricultural Science and Veterinary Medicine (AMV). The School includes 208 professors from 4 different Departments and gather 3.500 students from 18 bachelor and master degrees.

The AMV School joined the T4L@UNIPD programme organizing a residential weekend course of innovative teaching, where the 37 self-selected professors involved were strongly interested and motivated to participate, with a significant inclination to share their teaching experience. The proposed programme has been described above (Introduction) and aims at beginning a faculty learning community. The residential weekend, held in a place located far from the university campus, made possible a greater sharing of objectives favoring constructive interaction and socialization between participants.

The programme was significantly appreciated as reported in Fig. 1
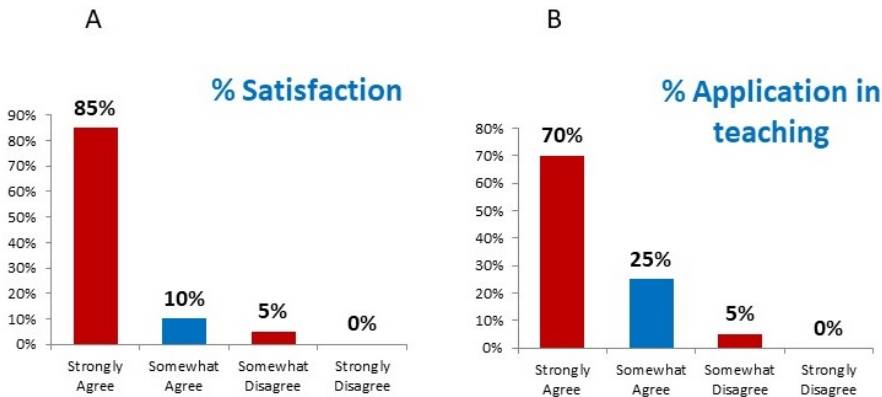
Figure 1. Result of the survey among participants to AMV school T4L@UNIPD programme

After this experience, the AMV School joined a second level experience promoted by UNIPD and aimed at training 30 selected professors (among them, 9 from the AMV School) in order to improve teaching and innovation within their Departments, including reflection

activities, training and sharing of successful teaching practices. The final purpose of the course is to form a community of *Change Agents* who will assist and help teachers in their activities.

3. Future implications for innovative teaching in AMV School and final reflections

The satisfaction index compiled at the end of the first course is encouraging and shows an interest and availability of the professors belonging to AMV School to be part of this change process under the supervision of the *Change Agents*.

The *Change Agents* promote the development of different activities with the aim to introduce change in teaching. In particular, they are developing: sharing of ideas and strategies to promote peer observation among colleagues (mini-teach and observation in the classroom), deepening of methods and techniques of active-learning (group activities, workcafè, application of online tools for interactive activity and feedback such as: Kahoot, Top Hat etc.), the promotion of self-directed learning processes, the elaboration of a syllabus according to constructive alignment.

In conclusion, the AMV School through the *Change Agents* intends to develop a learning community which recognizes a full role to teaching within the University missions, aims at collectivizing teaching experience to gain awareness about different personal potentials and, last but not least, intend to facilitate student learning processes by their active participation in the teaching activity.

The AMV School throughout the activity of the *Change Agents* are developing methods useful to monitor the impact of the innovative teaching programme on students by evaluating assessment questionnaire and performance of final exams.

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'Teach the teacher': Design and evaluation of a professional teaching development program

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Abstract

A significant aspect of engineering education is the tutorial experience. This article describes the development and evaluation of a Tutor Development Program delivered within a School of Engineering in one of Australia's leading universities. The paper presents a novel framework for an extended tutor professional development program that fosters interactive ways of engaging students. Evaluation of the program involved feedback from participating tutors, their students and the program facilitator. Our results show that tutors found the program extremely useful and, in turn, their students responded positively to the strategies tutors implemented. Observations by the program facilitator support these findings. We argue that an extended professional development program that facilitates active engagement is a crucial component in engineering education.

Keywords: Teaching development program, active learning, evaluation, quantitative, qualitative approach

1. Introduction

The focus on student centred learning has compelled universities to address the professional development of their tutors (teaching assistants). Tutors teaching in small classrooms are more likely to engage with students and have impact on their students' learning experiences in tutorial environments (Christie and de Graff 2017; Freeman et al. 2014). It follows that if informed and effective teaching practice is to be implemented across all engineering programs, tutors need to learn *how to teach*. The challenge is to design the kind of program that would equip our novice tutors with both the skills and perspectives needed for teaching. In particular, most tutors in Australian Universities are students themselves, undertaking a postgraduate program in the university, have never taught before and many have experienced very different educational experiences in their home countries. It is therefore our responsibility to prepare and upskill these tutors for positive teaching experiences. In this paper we outline the key literature we used to provide a pedagogical basis for a professional Tutor Development Program (TDP), its content and the evaluation of the program's effectiveness for both students and the tutors. We realized that we could not achieve our desired learning outcomes with a single session, or indeed, an online program. We therefore designed a six week professional Tutor Development Program (TDP) and evaluated its effectiveness for positive teaching and learning experiences.

2. Background literature

Our program needed be transparently robust. We had to be able to explain to tutors that the approaches we were asking of them were not just a case of *this is the way we do things around here* but content founded on pedagogical theory and research. It was also crucial that tutors be introduced to the fundamentals of what it means to teach in ways that provoke students become independent learners; to be able to take what they have learned and apply in unfamiliar contexts. Furthermore, the disciplines of engineering and IT cover broad territory. Below are some key concepts used in the literature.

There is an understandable tendency to teach in the manner in which we ourselves were taught. Mazur (2009) admits that as a new academic he did not reflect on how he would teach his students – he simply did "what his teachers had done". For our program, the activity of *reflection-in-action* (Schön, 1987) whereby the act of reflecting takes place during the experience when there is opportunity to have positive impact. Ramsden (2003) points out that *"good teachers are always evaluating themselves"*. The TDP requires that participants must be currently employed as a tutor. In this regard, tutors become engaged in what Lave and Wenger (1991) refer to as a *community of practice* – an interactive group that embodies the desired beliefs and practices that members wish to develop and practice. It is argued that learners tend to be more inclined, more motivated and feel compelled to

learn through their engagement in an authentic context. Hence, the TDP becomes a *community of tutoring practice* and in a position to draw upon the benefits of the immediate nexus between tutoring practice and professional development. For the most part of the 20th century, Australian universities have clung tight to the idea of *"content-driven telling"*. Amid mumblings of change, came the work of John Biggs (2011, 2016) who encapsulated the essence of what it means to teach effectively by reawakening Thomas Shuell's (1986) quote *"…what the student does is actually more important in determining what is learned than what the teacher does"*. The works of John Biggs and Paul Ramsden (2003) provide coherent arguments for the *constructivist* approach to university teaching. In the constructivist model, the tutor does not 'impart what I know', but rather generates opportunities for students to actively make sense of what it is they are experiencing.

In a comprehensive meta-analysis of 225 studies by Freeman et al (2014), findings reveal that average examination scores improved by about 6% when active learning strategies were employed. The work concludes by stating that the study's outcomes *"support active learning as the preferred, empirically validated teaching practice in regular classrooms"*. Modelling is perhaps the most fundamental means of learning. As Bandura (1977) explains *"most human behaviour is learned observationally through modelling: from observing others one forms an idea of how new behaviours are performed and on later occasions this coded information serves as a guide for action"*.

Asking thought-provoking questions is an essential skill for any tutor. The right kind of question, King (2002 p. 4) argues, *"opens the door to student's participation"* and to students *"applying their current understanding to the content or the problem"*. King (2002) adds, *"the problem is to stop teachers from precluding the chance for that to happen"*. One aspect embedded in the program was that of helping our tutors become aware of the importance of providing a *safe* learning environment where students feel comfortable to proceed from 'not knowing' to confident acquisition. Evidence from recent neuroscience research suggests that if learners feel stressed in their learning environment they are less able to build the necessary neural connections (Willis, J. 2007). Finally, peer teaching and peer discussion are becoming recognised strategies that enable students to actively learn through interaction with another student (Crouch and Mazur, 2001). These studies utilize the effectiveness of peer interaction in his 'turn to your neighbour' activity; the *ConcepTest.* The TDP has consciously used this method in educating tutors.

3. Tutor Development Program (TDP) and Evaluation

Our aim was to design a program that equips our novice tutors to facilitate effective teaching and learning experiences. Below we describe two aspects: (1) the TDP framework (Section 3.1) and (2) an evaluation the effectiveness of the TDP (Section 3.2).

3.1. Professional Tutor Development Framework

It is expected that by the end of the program, tutors are able to: *plan* tutorials with stipulated learning outcomes; *interact* with their students individually and collectively; *manage* differences in student capability, personality, degrees of confidence and language fluency; *explain* clearly and logically concepts and procedures; *thoughtfully and respectfully manage* those students who may dominate, distract, appear disinterested or disengaged; *encourage* students with respect and patience; *engage* students intellectually through active participation, challenging students to think and express those thoughts; and *reflect* on their tutoring practice in order to implement ongoing improvement.We developed a six-week program beginning with a Professional Development Day prior to the start of semester. This is followed by two-hour workshops during the subsequent five weeks. Below is the current framework of the TDP as shown in Figure 1.
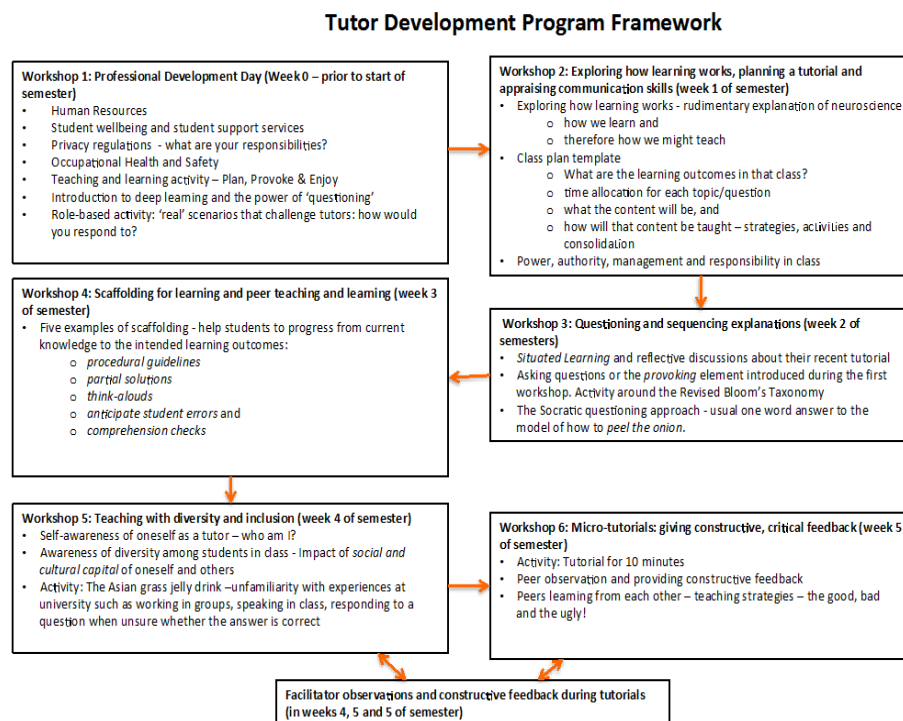
Figure 1. Tutor Development Program Framework.

This includes all tutors being observed for a minimum of 30 minutes by the TDP facilitator (see Figure 1). Constructive feedback, compliments on effective teaching, reminders of where students could have been worked harder or strategies that might be implemented are emailed soon after to the tutor by the facilitator.

3.2. Evaluation

Evaluation of the research involved: (1) Feedback by the tutors of their experience of the usefulness of the TDP to their teaching; and (2) Feedback by the students of the tutors. We acknowledge some of the inherent problematic issues when conducting this kind of study that relates to the capacity of a student to judge good teaching and queries whether student evaluations are more about popularity (Hornstein, H. A, 2017). Our focus was to ask the students to respond according to their learning experiences. Although the TDP has continually revealed high tutor satisfaction ratings since its inception, we needed to capture whether these students, the ultimate stakeholders, respond positively in terms of their learning, when taught by 'trained' tutor? To that end we collected: (1) feedback from tutors that attended the program in two semesters; and (2) feedback from students about their tutors who had attended the program. In order to gather feedback from tutors, we used a questionnaire that had two components; (1) on a Likert scale of one (strongly disagree) to five (strongly agree), against perceptions of the Program's *usefulness* or *helpfulness* to their classroom tutoring; and (2) list of the teaching strategies developed during the program that they have implemented in their classrooms. With ethics clearance in hand, fifty-seven (57) tutors who attended the TDP agreed to participate. Further, we invited students whose classes were taught by tutors who had just completed the TDP.

A total of 186 students from seventeen (17) such tutors agreed to provide feedback on their learning experiences on their classroom tutor. The students were asked the following questions on a Likert scale of one (strongly disagree) to five (strongly agree): (1) *Overall, the tutor's teaching strategies helped me learn*; (2) *The tutor has good organisational skills (was punctual, prepared);* (3) *The tutor's explanations were clear and understandable;* and (4) *The tutor helped me gauge my understanding and progress in this subject.* We also asked students an open-ended question: *"List briefly what the tutor did that helped you to learn. Please provide examples"*.

Tutors' self reports on the TDP: At the conclusion of their six-week program, fifty-seven (57) tutors were asked to anonymously provide both closed and open feedback on their experience of the TDP. Firstly we asked tutors to complete a statement, using a Likert format - "From my perspective, the Tutor Development Program was… " (1) *Rarely useful or helpful*; (2) *of little use or help*; (3) *no opinion either way*; (4) *often useful or helpful*; and (5) *extremely useful or helpful*. Fifteen tutors out of the 57 (24%) indicated that they found the program to be *often useful or helpful* in their tutoring practice. However, most tutors (74%) indicated that the program was *extremely useful or helpful* as shown in their responses. Secondly, we were keen to find out what particular skills the tutors report having learned during the TDP and transferred into their classrooms. Tutors were asked to respond to the statement: *"If applicable – list the teaching and learning strategies [that you developed during the Tutor Program] that you now employ in your tutorials"*. Each tutor

wrote multiple responses to this question. In total, we collected 202 responses. These responses were condensed into five dominant themes. Tutors reported: (1) Employing questioning strategies to provoke thinking; (2) Engaging students in peer interaction; (3) Explaining concepts clearly; (4) Working at generating a safe and respectful learning environment; and (5) Providing scaffolding strategies to support learning. The results show that tutors have recognised the crucial importance of questioning as fundamental to student engagement. This is evidenced in comments from tutors who wrote that they, *"Always ask why we need this, why is this different, why does it work this way – connecting things together by asking why"*. Tutors recognized the value of collaborative learning, *"We should create opportunities for them to share ideas and learn from each other"*.

An effective teacher is one who has the ability to explain complex concepts clearly and simply especially in the engineering discipline. This practice has been reflected in the responses the tutors provided: *"Use examples from the real world to relate concepts with concrete objects"*. Scaffolding strategies are techniques that teachers employ to help their students progressively move towards becoming independent learners. Tutors report that they have used a variety of scaffolds in their classes. For example, *"Partial solutions – I use it with mathematical problems as it encourages many people to answer"*. The scaffolding strategy *think-aloud* was also reported as being used by a tutor, *"Explaining my thought processes when reading and tackling a question"*. Learning from the TDP, some tutors also noted the importance of using respectful interaction as picked up from the TDP: *"Previously, I think it might have been okay to ask a person directly a question if he or she is not paying attention to the class as a reminder for him or her to pay attention... it is not okay to do so because a tutor should not use questions as a weapon to attack students"*.

Students' feedback on their learning experiences with their tutor: In this formal evaluation study, 216 students provided feedback on their learning experiences in a tutorial delivered by one of their TDP tutors. We asked students to respond specifically to what only they can tell us. That is, their experiences of: (1) their tutor's organizational skills; (2) the tutor's skills in encouraging participation; (3) the tutor's clarity of explanation; (4) the tutor's strategies in helping students gauge progress; and (5) the students overall experience of their tutor's teaching strategies. A feedback questionnaire was used as shown in Figure 2 along with an open question (2) *If applicable, how did this tutor help you learn?* Most students (94%) strongly agreed or agreed that their particular tutor's organizational skills were good (emphasis on time-on-task) and that their teaching strategies helped the student learn. Further, the student responses (90%) indicate that they thought that their tutor's explanations of a topic were clear and engaging. Students' responses show that 88% of students felt that their tutor helped them gauge their understanding and progress in the subject. They (88%) felt that they were encouraged to participate in their tutorial.

In response to the question: *If applicable how did this tutor help you learn,* we identified four particularly dominant themes that were revealed from the 216 student responses. It was evident that a tutor's *friendliness* and *supportiveness* had positive impact on the students' learning experiences. Students reported that the tutor generated a *"friendly relaxed atmosphere where it was encouraged to ask questions... if I do not understand the reasoning behind something I do not hesitate to ask about it and I am confident I will receive a good answer"*. The value of being asked questions and not being 'spoon-fed' was noticed by students: *"He asked questions which facilitated my learning"*. Giving explanations is a fundamental aspect of engineering tutorials. It is not surprising then, that the quality of tutors' explanations did not go unnoticed, students said: *"step by step explanation in the class has been very helpful"*. The fourth dominant theme – *encourages group discussion and interaction* shows that students recognise active learning strategies as a helpful to their learning. For example: *"the tutor aided learning by giving time for discussion of the subject material"*. Students appeared to be aware of the teaching strategies that fostered interaction, *"...for many questions (he) will ask students to write on the whiteboard which I find (makes) the class more interactive"*.

4. Discussion and conclusion

This paper has endeavoured to describe a program that we believe effectively equips our tutors to develop the capabilities that foster positive teaching and learning experiences. For us, a key indicator of the success of the TDP, was evidence that tutors provoked their students to *actively think*. Too often we do the thinking for our students. And too often we deliver up a pre-digested diet of neatly turned out ideas, concepts, theories and practice with little effort on the part of those sitting down. For many tutors, their educational experiences have been embedded in a teacher-directed environment where teachers *deliver* content and students are passive *listeners*. For these tutors, it was a significant and often difficult transition from the idea of 'telling' students or 'imparting my knowledge' to a more student-centred approach involving active and engaging participation. The difficulty lay not in appreciating the strength of student-centred learning approaches but rather in the confidence of executing them.

We argue that the nature of our program is designed to model the kind of engaging learning environments that we would like our tutors to generate in their classrooms. While a small number of tutors start the TDP with less than desirable enthusiasm, by the end of the third workshop, these tutors are observed to be keen and actively engaged. Similarly we realise that not all students are keen to attend their tutorials, but hopefully the kind of active learning experiences offered by their tutors will encourage those students to attend their tutorials. If designing and delivering a tutor development program was problematic, and then evaluating such a program was also a challenge because of complexities in context,

content and diversity. A limitation in our study was that we could not evaluate the program under controlled conditions where the effectiveness of teaching and learning experiences could be manipulated. However, we have evaluated our program by triangulating feedback from a range of sources including tutors that attended the program; students of those tutors; and observations from the facilitator of the program. Given the findings in this study, we recommend a tutor development program be implemented within engineering faculties to build confidence and capabilities in tutors by exposing them to best teaching practices for enhanced learning experiences of their students.

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Compliance of MOOCs and OERs with the new privacy and security EU regulations

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Abstract

Since their appearance in the early 2000s, Massive Open Online Courses (MOOCs) and Open Educational Resources (OERs) arose among the most important educational priorities. Many top universities worldwide have been involved in the research and direct implementation of this innovative pedagogical approach. Simultaneously with the development and massive deployment of the new learning and teaching method, European regulations responsible for data privacy and information security protection have significantly evolved. This paper assesses the compliance of the ten most popular MOOCs and OERs with the General Data Protection Regulation (GDPR) and the Directive on security of network and information systems (NIS Directive). In order to systematically examine their online platforms, a few privacy indicators were outlined and thoroughly observed. Alongside this, the involvement of the open education providers in the NIS Directive was examined. Research findings are presented and elaborated in a way that it makes easy to generate recommendations on how to anticipate the future of open education as a reasonable reaction to global change in the era of rapid technological growth, and at the same time to obey the crucial ethical principles defined by this development.

Keywords: GDPR; ISO Standardisation; NIS Directive; Privacy obliteration; Security attacks.

1. Introduction

The internet and its considerable popularity enabled the birth of open learning, initiating dramatic changes in education by enabling access to all the learners and teachers (Bonk, 2009). The UNESCO forum on the impact of open courseware held in 2002 defined Open Education Resources (OERs) as "technology-enabled, open provision of educational resource for consultation, use and adaptation by the community of users for non-commercial purposes". It promoted the idea of full and open access to learning objects. This initiative formally recognized the open coursewares (OCW), which were founded in 1999 with the recorded and online published video lectures by the University of Tübingen (https://timms.uni-tuebingen.de/), but became widely appreciated in 2001, when Massachusetts Institute of Technology (MIT) started making their educational materials publicly available, online and for free,, as part of the MIT OpenCourseWare (MIT OCW) (https://ocw.mit.edu/index.htm). Since 2002, OER and OCW are used interchangeably.

Learning objects were introduced in 1994 by Wayne Hodgins (Hodgins, 2006). According to Hodgins (2006), taking into consideration their role of core elements for content creation and distribution, learning objects will "increase and improve the effectiveness of learning and human performance". His optimistic expectations were embodied in the Massive Open Online Courses (MOOCs), which were first mentioned by Cormier (2008), who coined the term to label the distributed online course "Connectivism and Connective Knowledge", created by Stephen Downes and George Siemens (2008). Apart from contributing to the first MOOC and authoring the corresponding online book (Downes, 2012), Downes believed that the new approach was more creative and dynamic in comparison to the existing ones, which according to him resembled "television shows or digital textbooks" (Ossiannilsson, 2014). For less than 10 years, MOOCs became immensely popular, enabling millions of learners to extend their knowledge and competences in various topics at different educational levels, and by providing a certain fee, they can obtain a verified certificate in the area.

There is not a strict distinction between MOOCs and OERs. The timeline published by Yuan and Powell (2013) suggests that all MOOCs are influenced or directly related to open education, making them successors of OERs. The UNESCO guide suggests that OERs are resource-based, with openly licensed content, usually under Creative Commons copyright licenses (https://creativecommons.org/), and not necessarily shareable in digital format (Butcher, 2015). MOOCs can have flexible design and resources (Lambert, 2015), they are neither massive nor free (Kilgore and Lowenthal, 2015), and as the second 'O' in their acronym indicates, all the communication and content sharing is online. Nevertheless, MOOCs and OERs are usually jointly presented, such as in the topics of interest of HEAd'19. Consistently, ten popular MOOCs / OERs, which will be examined in the rest of the paper are also jointly presented. They include: Alison, Coursera, CourseSites, edX, FutureLearn, Khan Academy, LearningSpace, MIT OpenLearn, OpenCourseWare, and Udacity.

The paper proceeds with Section 2, which examines open education privacy policies, data protection and their compliance with GDPR. Section 3 starts with the security glitches in education, and continues with the direct involvement of Universities and research centres into the NIS Directive, whereas the last section presents the concluding remarks, which are deduced from the previous sections.

2. Data privacy in open education

Student education records contain a lot of sensitive data and confidential documents, including personal data intended for student identification and interaction, like e-mail addresses, but also information about the student's presence at lectures, performance at assignments and exams, facts about the student's behavior and discipline, including the measures against bad performance or misconduct. Learning management systems (LMSs), which are the crucial framework of all the examined MOOCs / OERs have a direct overview of student activity logs. These logs contain additional sensitive information, for example the IP address, login time and duration, as well as indicators of students' mutual communication. All these data and logs are visible to those teachers who are responsible for managing the courses the students are enrolled in (Hew, 2016). Some educational information and records are extracted from LMSs and then presented in a form of student report cards or academic performance certificates to potential internship providers, prospective employers, state institutions or educational institutions offering grants and loans, as well as to foreign institutions and governments, for example for obtaining a visa or a work permit. The awareness of such data collection, and the privacy perception is definitely one of the key predictors for using open education services (Arpaci, Kilicer & Bardakci, 2015).

Many programs and laws protect student privacy. Since 1974, the Family Educational Rights and Privacy Act (FERPA) is regulating the rights of accessing education records in USA (https://www.cde.state.co.us/cdereval/ferpa). In spite of its long history and implementation, first complaints against FERPA have emerged only recently. They cover the improper protection of "information that does not fit into definition of an education record", and the violation of state open record laws, which are additionally controversial due to the loopholes in the federal privacy laws (Elliott, Fatemi, & Wasan, 2014).

Although this paper examines EU regulations, most MOOCs and OERs are registered in the USA, so EU users are complying with US regulations too. This was one of the causes for the EU-US and Swiss-U.S. Privacy Shield (https://www.privacyshield.gov/welcome). Europe has recently started implementing the General Data Protection Regulation (GDPR), which contains the reciprocal EU regulations for the protection of international transfer of personal data outside the EU for commercial purposes (https://ec.europa.eu/info/law/law-topic/data-

protection/data-transfers-outside-eu_en). In parallel with these rules, GDPR regulates privacy in education (https://ec.europa.eu/info/law/law-topic/data-protection_en).

In January 2014, an ambitious European project, called Higher education Online (HOME) was launched (https://home.eadtu.eu/). It unites 23 European educational institutions, whose aim is to create and implement MOOCs "the European way". One of the crucial values of the project is "full privacy for all respondents". The privacy policy of the European Association of Distance Teaching Universities (https://eadtu.eu/), which is responsible for managing this project has been adjusted to "comply with applicable data privacy" and control "personal data under the GDPR" (https://eadtu.eu/privacy-policy). The policy introduces the five areas of concerns: data collection and use; data sharing; retention periods when storing personal data; cookies; and privacy rights and contact. They are all incorporated within HOME.

Is the same approach implemented in the popular MOOCs / OERs worldwide? The major privacy concern reported so far deals with the considerable sharing of learner data (Reich, 2015). To minimize the risks, Reich suggests protection of learners' anonymity and technical solutions that will enable safe data sharing. Another problem is that most learners are non-experts and they don't know how to manage their online privacy (Egelman, Bernd, Friedland & Garcia, 2016).

After examining the age restrictions, the collection of age data, the amount of cookies, provided data dashboards, and the contact information regarding data from Coursera, EdX, and Blackboard's CourseSites MOOCs, Jones and Regner (2015), revealed "inconsistencies among MOOC platform and the level and type of legal uncertainty surrounding them". However, the most worrying is the fact that the student awareness about privacy issues and threats is rather low (Frost & Hamlin, 2017). This fact was confirmed by a survey made with 259 students from 34 nations. After examining many different questions, Frost and Hamlin (2017) concluded that "the responses indicate a lack of basic understanding about Internet security". Privacy was not mentioned at all.

Table 1. presents the privacy indicators of the ten MOOCs / OERs, which were announced in the introduction of the paper, as they are available from their sites. After the platform name, its URL and the country of origin, the following privacy indicators are displayed: visitors' consents to obtain and store cookies, visibility of the privacy policy, collection of sensitive data, collection of online habits, and finally, data mining of collected data.

Sensitive data encompass the following information: 1: name, 2: date of birth, 3, gender, 4: country of residence, 5: e-mail, 6: home address, and 7: phone number. Online habits embrace: 1: time of accessing the system, 2: pace of opening and elaborating new lectures, 3: amount of attempts during online assignments, 4: participation in discussions, 5: supporting other colleagues, 6: content of discussion threads, 7: asked assistance from professor, 8: learning habits, 9: reading habits. The suspicion that MOOC / OER perform

data mining of the information collected from their learners is confirmed with the reports published by themselves.

Table 1. Privacy issues of the most popular MOOCs and OERs.

Name of the platform	Country	Cookie consent	Privacy policy	Sensitive data	Online habits	Data mining
Alison alison.com	Ireland	No	GDPR adjusted	1, 5	1, 2, 3, 4, 8, 9	N.A.
Coursera www.coursera.org	US	No	GDPR adjusted	1, 5	1, 2, 3, 4, 5, 6, 7, 8, 9	Yes
CourseSites coursesites.com	US	Yes	Detailed advanced	1, 4, 5	1, 2, 3, 4, 5, 6, 7, 8, 9	Yes
edX www.edx.org	US	No	GDPR adjusted	1, 4, 5	1, 2, 3, 4, 5, 6, 7, 8, 9	Yes
FutureLearn www.futurelearn.com	UK	Yes	Detailed advanced	5	1, 2, 3, 4, 8, 9	Yes
Jisc www.jisc.ac.uk/	UK	No	Short outdated	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 4, 5, 6, 7, 8, 9	Yes
Khan Academy www.khanacademy.org	US	No	GDPR adjusted	1, 2, 5	1, 2, 3, 7, 8, 9	Yes
OpenCourseWare ocw.mit.edu/index.htm	US	No	Short outdated	No registration	None	N.A.
OpenLearn open.edu/openlearn	UK	Yes	Detailed advanced	1, 2, 4, 5, 7	1, 2, 3, 4, 5, 6, 7, 8, 9	Yes
Udacity www.udacity.com/	US	Yes	GDPR adjusted	1, 5	N.A.	N.A.

In spite of EU regulations, only FutureLearn and Open University's OpenLearn require cookie consent from their visitors. Majority of US sites simply ignore this. Apart from Jisc, which is a warehouse of UK higher and further education and MIT's OpenCourseWare, all other MOOCs / OERs have adjusted GDPR privacy policies. CourseSites, FutureLearn and OpenLearn have implemented even more information regarding their GDPR policies. The amount of collected personal data during registration varies from e-mail only, to all the data in Jisc. Although registration is not enabled, learners officially enrol to UK Universities, thus all their data are collected by the corresponding schools. Online habits are closely observed and pass through detailed data mining in Coursera (Mukala et al., 2015), CourseSites

(Holcomb & Buell, 2016), EdX (DeBoer et al, 2013), FutureLearn (Hodge, 2016; (Hone, Kate & Ghada, 2016), and OU OpenLearn (Johnson, 2015). All in all, MOOCs / OERs lightly comply with GDPR. This problem should be resolved as soon as possible.

3. Data protection

The most recent report on Distributed Denial of Service (DDoS) attacks from October 2018 revealed that the peak period of their occurrence was September, and that "the primary target, year after year, is the education system, attacks being directed at the web resources of schools, universities and testing centers" (Kupreev, Badovskaya, Gutnikov, 2018). The target of the great DDoS attack in September 2018 was University of Edinburgh, which is part of the UK MOOC Jisc (McLachlan, 2018). In the statement about the severe security glitch, McLachlan (2008) said that it was "a cyber attack on their network and against other UK Universities". Jisc's security operations centre head Chapman (2018) revealed that the pick of such attacks coincided with the beginning of the academic year, with in average 10 DDoS attacks daily, while the holiday periods were usually idle. Additionally, the discovered attack pattern indicated that attackers were usually students who sometimes purchased the DDoS packages from so called "booter" or "stresser" sites (Whittaker, 2018). If there is a doubt that Udacity was hit by a massive DDoS attack (https://twitter.com/udacity/status/869222317787717633), it is explicitly acknowledged that the developer platform GitHub was a DDoS victim (https://githubengineering.com/ddos-incident-report/). Universities are sometimes infected by ransomwares. University of Calgary experienced a ransomware attack in 2016 (https://www.ucalgary.ca/risk/node/30), while University College London was a victim of a similar vulnerability in 2017 (https://www.bbc.com/news/education-40288548).

All the security weaknesses mentioned in the previous paragraph were promptly removed mainly because the greatest security experts are associated with Universities and research centres. Accordingly, they "have a decisive role to play in spurring research, development and innovation in those areas" (https://eur-lex.europa.eu/eli/dir/2016/1148/oj). The European Union Agency for Network and Information Security (ENISA), as a centre of expertise for cyber security in Europe, established its own MOOC, which embraces 535 courses from 28 European countries. Apart from this MOOC, Jisc endorses the Directive (https://community.jisc.ac.uk/taxonomy/term/nis-directive), while US based Coursera is providing training materials "for implementing the EC roadmap NIS education" (https://www.enisa.europa.eu/publications/roadmap-for-nis-education-programmes-in-europe). Others have no visible signs to cooperate or implement the Directive. One of the ENISA's goals is NIS Standardisation (https://www.enisa.europa.eu/events/enisa-cscg-2017/presentations/purser), which suggests: ISO SC27 for privacy, ISO 15408 for security assurance and ISO 2700 series for organisational management for secure operations. To the best of the authors' knowledge, none of the examined MOOCs / OERs are unambiguously indicating the fulfilment of any of

these standards. On the other hand, all of them (N.B. except Knan Academy) offer courses about ISO standardisation, which proves their awareness about them. Consequently, if they are not already, they can easily become fully ISO complaint, which will immediately trigger their compliance with the new EU security regulations.

4. Conclusion

Coursera, edX and Udacity were launched after 2011. Jointly, in less than 8 years, they have reached more than 50 million students and offered more than 5000 advanced education courses. Fascinated by the openness and social interactions of the open educational model, together with the possibility to obtain a valuable certificate of course completion or a recognized University degree, many learners have actively participated and completed the MOOCs. Their success stories trigger new prospective learners to experience open education.

The greatest responsibility for sustainable MOOCs / OERs falls on their providers. Together with the attractive courses, good learning resources, and experienced educators, who are motivated to innovate the learning process, the MOOC platforms should protect students' human rights and values. However, every year, the data privacy and security risks increase. To protect learners from these escalating hazards, the regulations should be carefully obeyed.

The study of the most popular and influential MOOCs and OERs has shown that, despite that the awareness of the new EU regulations is high, very few steps have been made to implement data protection rules and to protect learners' privacy. In short term, it will not affect the popularity of open education, but gradually, as learners seek greater protection from any privacy threats (Lorenz et al, 2013), if the protection is not equally offered, this education model might collapse.

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Reflections on Sustainability Issues in Learning Object Development

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Abstract

Data science is a relatively new requirement in business curricula. Historically many business students have shied away from business statistics. We describe a project to create learning objects to enhance business students confidence and capabilities in performing statistical and analytics business tasks. In this paper we focus on the content development process, rather than the impact of the learning objects on student learning outcomes. We reflect on the steps in the learning object design and implementation project and conclude that the Plan, Act, Observe and Reflect iterative cycle worked well for the project team. We include recommendations on how this framework could be augmented to improve the sustainability of learning objects.

Keywords: Innovative Learning Materials; Learning Object Development; Quantitative Skills Development; Learning Object Sustainability.

1. Introduction

The disruptive effect of the analytics movement has caused many business schools to refocus curricula to emphasise the importance of data analysis to support decision making. Davenport & Harris (2007) outline how businesses can optimise business capabilities via analytics, thus positioning businesses who adopt an analytics approach to better compete. Mortenson et al. (2015) describe business analytics as a dianoetic management paradigm - which they describe as of, or relating to thought, particularly to discursive reasoning rather than intuition. They describe the analytics movement as progression of normal science and note that what we come to know, we add to curriculum.

However, business students demonstrate a lack of interest in statistics and data analysis, despite the many career opportunities emerging in this area. In this paper we present one component of an action research project to engage business students with analytics. We describe the development of a set of short videos aimed at aiding improving students' understanding of both statistical concepts and the statistical language and symbols associated with the concepts. We summarise our experience in designing and creating the videos and reflect on sustainability of the approached we used.

2. Business Analytics Education

The business analytics movement has prompted the adaption of traditional business statistics courses to address the growing need for business graduates with an understanding of analytics and evidence supported decision-making.

However, the challenges of engaging business students with quantitative and statistical topics are well documented, see for example Stevens and Palocsay (2012) and Carroll and White (2017). Business students often feel that analysis and statistics are boring and not relevant to the real-world. They consider quantitative courses the most difficult and challenging courses in the business curricula. They perceive that analysis is required in business, but not that they may become responsible for performing or interpreting that analysis Cronin and Carroll (2015).

Business analytics undergraduate education is concerned not so much with the development of novel methods or software. Rather it relies on the statistics and computer science communities for those resources. Instead a knowledge of the appropriate methods and their underlying assumptions is what undergraduate business students need, so that they can model real-world problems and use the methods and software to solve the modelled problem. The challenge for business students is then to map a textual description of a problem to a mathematical or statistical encoding of the problem.

Cañadas et al. (2018) note that students have difficulties transforming verbal reasoning (a real-world natural language representation) into algebraic symbols and vice versa. Yet mathematical and statistical symbols and language are required to encode the real-world problem into a format that can be solved by a computer (algorithm).

Gravemeijer et al. (2017) also remark that at school it is the teachers who formulate the (mathematical) problem and students who try to solve it. In contrast in the real-world, the challenge is to formulate a mathematical problem and try to get software to solve it.

The majority of undergraduate business students at University College Dublin, Ireland, enter the business programmes based on their grades in standard state exams. The programmes stipulate a minimum mathematics score as an entry requirement and students demonstrate varied mathematical abilities, ranging from meeting the minimum requirement, to the highest possible score in the state exam.

Business analytics education at University College Dublin has shifted away from teaching competencies that compete with what computers can do, and focuses on competencies that complement computer capabilities. Students are required to take core modules in data analysis and mathematics in their first year. We focus on the application of descriptive and inferencial statistics to support decision-making in a business context. Students use spreadsheet tools to perform analyses. Lecture content uses both natural language and the language and symbols of mathematics and statistics to connect concepts to practice. Our motivation for this approach is that algebraic symbols offer a common language to encode mathematical or statistical models of real-world business problems. However, our experience shows that many business students find the use of these symbols and language challenging.

Our response to the challenges outlined above is an overarching action research project to reflect on the learning resources and methods of delivery of the core data analysis module to engage business students with data analysis while remaining cognisant of assurance of learning concerns. By engaging with research and reflection on our own actions, we aim to identify subsequent developmental actions with the overall objective of improving the student experience of learning data analysis, and of improving their attainment of the module learning outcomes. We think of action research as a continual cycle of planning, acting, observing and reflecting.

Performing mental arithmetic activates similar brain activity as actually counting on our fingers. Dehaene et al. (1999) argue that the capacity for mathematical intuition requires both linguistic competence and visuo-spatial representations, and we believe the same is true in analytic thinking. By focusing on the design issues of quantitative learning resources, the resulting resources may enable some aspects of the mathematical thinking/ mental modelling processes in certain students. It should aid the acquisition of

mathematical/statistical/data science concepts and assist students to achieve module statistical learning outcomes.

The use case in *Section 3* describes a content design project aimed at creating a set of short videos that aim to improve students grasp of the use of symbols in statistical concepts and support their statistical literacy development by exploring the meaning of symbolic algebraic statements.

3. Use Case: Developing Short Videos to aid Quantitative Skills

The project was prepared using a Learning Object Metadata (LOM) schema (IEEE, 2002), with the aim of producing a sustainable content project which when set up initially, could then be iterated or repeated, without significant additional set up. The IEEE defines learning objects as "any entity, digital or non-digital, that may be used for learning, education or training". The IEEE LOM assists in creating structured descriptions of learning resources which are useful in collaborative projects to facilitate a shared understanding of the resources. LOM should support the sustainability of the resource and promote its re-use and deployment in virtual learning environments. Table 1 shows an extract of the LOM for the videos. The video learning outcomes are linked to the learning outcomes of the business modules taught by the PIs.

The initial time commitment included metadata creation, project scoping, script development, animation, audio recording, video editing, and project management. The College of Business eLearning team were able to provide advice on learning object development and met with PIs and their designer to offer guidance and support.

3.1. Project Objective

Some research shows that both linguistic and visuo-spatial cognitive processes are at work during quantitative problem solving. However, some business students find the use of statistical formulae daunting. This may act as a stumbling block if their focus is diverted to understanding the symbols (the linguistic bit), rather than developing an understanding of the statistical principles. Their focus is often on how to apply a formula, rather than understanding the insights (often visuo-spatial representations) that arise from the application of the formula. The objectives of these learning resources are to aid business students in developing statistical thinking capabilities, and to help develop awareness on their inherent statistical thinking in their everyday lives by presenting contextualised examples of the application of business statistics. These resources were chosen for their broad application within the subject area and programmes within the school.

Table 1. Video Learning Object Summary

Title	Learning Outcome	Run time (min: sec)
Calculating Averages	Calculate the average or mean using algebraic symbols.	03:07
Interpreting Averages	Calculate, interpret and present useful statistical measurements from large-scale data sets.	01:57
Sample Variance	Calculate variance and standard deviation using algebraic symbols.	02:54
Interpreting Variance	Calculate, interpret and present the variance and standard deviation of large-scale data sets.	02:15
Interpreting Correlation	Interpret the correlation coefficient from large-scale data sets.	02:14

Source: Univeristy College Dublin School of Business Media Server. (n.d.). Retrieved January 24, 2019, from https://qsblc.ucd.ie/channels/#learn-through-research_02154

3.2. Project Plan

An action research framework was selected to help guide the project. The strength of action research lies in its focus on generating solutions to practical problems and its ability to empower practitioners (Koshy, 2009). PIs secured funding to recruit a research assistant with multimedia skills. Together they finalised the project scope and agreed deadlines and deliverables. The PIs produced project metadata (LOM) and developed scripts. We started by identifying topics where the lecturers saw a need for visual learning resources. The draft list of topics to be covered aligned to programme and modules outcomes. The designer produced animations to accompany the scripts. Animations were reviewed in an iterative process. Audio was recorded and overlaid, and project outputs were published on the school's media server with support from the College eLearning team.

3.3. Project Implementation

The PIs secured funding from a university learning initiative seed fund. The action research project plan followed a Plan, Act, Observe and Reflect iterative cycle. Principle Investigators initiated the project, researched the data and acquired funding, developed the project scope, engaged a designer who developed content, oversaw the production of the

animations, evaluated the project, and sought revisions before releasing the content to students within the relevant modules on the virtual learning environment.

Design decisions in relation to font choices and colour schemes prioritised clarity, readability and accessibility. The voice-over actor was chosen as representative of the student's peer group for relatability. A background track was used to add audio depth. After Effects was selected as the animation tool for the project. This is a powerful animation and digital effects package, an industry standard for animation effects, which is widely available, with a firmly established skillset in the design industry. It allows the animation of hundreds of individual visual elements with multiple animated behaviours including position, scale, opacity and rotation. Sample screen shots are shown in Figures 1 and 2.
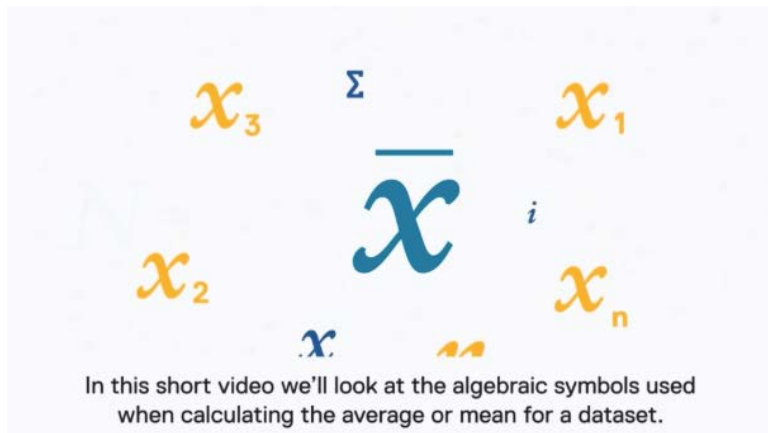
Figure 1. Calculating Averages [Video File]. Retrieved from https://qsblc.ucd.ie/videos/calculating-averages_58778/
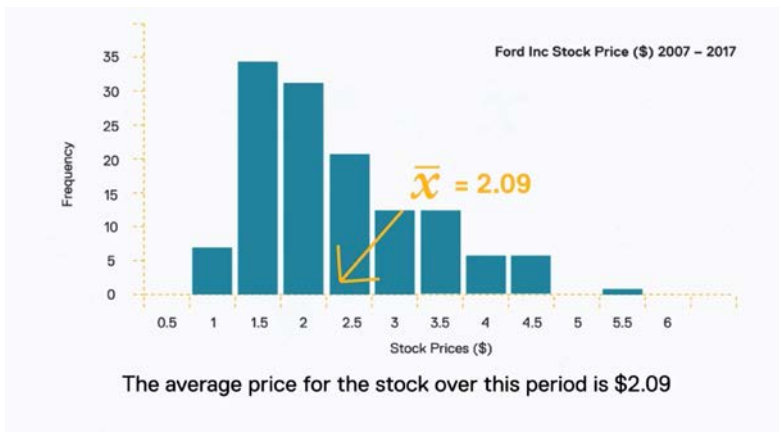
Figure 2. Interpreting Averages [Video File]. Retrieved from https://qsblc.ucd.ie/videos/interpreting-averages_20147/

The designer produced storyboards for the initial animation and developed visual elements for the animations that were signed off by PIs.

There followed an iterative storyboarding process, where the designer worked with scripts provided by PIs, developed the imagery and created an outline. Following feedback from the PIs, scripts were refined, then the designer produced animations to bring the script to life. Text overlays were added to the imagery to summarise the script and re-enforce learnings. The animations were reviewed, and some small final edits made. The audio recordings for the voice-over were all produced after all the animations were completed and finalised.

4. Recommendations and Conclusions

This project was time-consuming and required a large commitment from the production team. It was challenging for PIs to fit these responsibilities in with everyday teaching and research responsibilities. The videos have been published on the Management Information Systems module MIS10090: Data Analysis for Decision Makers. We can collect viewing data for the videos which are hosted on our media server. Access can be controlled for the videos, but currently sign-in is not required to view the videos.

We discovered how important it is for the voice-over actor to be comfortable with the kind of content they will be reading, that extra time be allowed for the actor to prepare, and that the actor might benefit from being involved earlier, so that any apparent difficulties with the script could be reviewed. Leaving audio production to the end was reasonable but meant no real consideration of script changes were possible at that late stage.

We have explored remastering the audio with an instructor's voice, and have done this for the first video in our series. We also shortened and re-timed the animation, which took significantly less time than the initial creation, demonstrating the intended sustainability. During re-editing having to manipulate each of the many visual elements can complicate what should be small edits.

Greater sustainability could be provided in the future by connecting these visual elements to an external data-source. Connecting the project files to a data-source could be a significant undertaking but might offer another method of updating the content without major changes to the animation project files, and might represent another step towards sustainability for the project.

The action research cycle helped organise the project, for future design projects a design cycle may provide a more suitable framework, as it may provide for more explicit design iteration.

While all source and project files were maintained by the designer, the importance of digital asset management became clearer when re-edits were required. A Digital Asset Management tool would be useful and a project archive should be kept so that all media, originals and derivatives are available if required. The further sustainability of any such project requires the underlying visual elements to be maintained. Where outside design assistance is sought, reproduction rights of all visual materials should be clarified.

At the conclusion of the project we have a completed series of videos which can be used to address student knowledge gaps for quantitative business subjects which are known to be problematic for business students, and have a roadmap which can be followed for the creation of future learning resources.

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MOHICANS: Mobile Learning Teaching Model for Next Gen Learners

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Abstract

The proliferation of mobile devices among especially the younger (aka Next Gen) learners has led to a change in expectations when it comes to learning. These learners prefer to learn "on-the-go" and to have the learning contents at their fingertips. However, design strategies for mobile learning are still in nascent development stages. This research builds on existing literature in the field of mobile learning pedagogy to propose a novel teaching model for mobile learning which instructors can use to design their own courses.

The research is conducted on 120 identified learners from 2 faculties, School of IT and School of Health Sciences who were undertaking their respective core modules. The participating instructors designed and implemented mobile learning packages in accordance with the proposed teaching model. The authors collected feedback from learners via survey questionnaires on a four-point Likert scale to measure the level of learners' satisfaction with the mobile learning packages. The authors also examined the module learning outcomes to gauge the level of instructors' satisfaction as well as the competency levels achieved by the learners. Both qualitative data and sentiments collected from survey and classroom observations have been encouraging, showing that the teaching model proposed is effective.

Keywords: Mobile Learning; Teaching Model; Elearning; Mlearning; Quality Dimensions; Design Strategies.

1. Introduction

Mobile electronic devices have come a long way, from being a niche technology to being an almost ubiquitous tool. In the realm of education, schools and educators are incorporating mobile learning into their curriculum steadily to tap on the affordances and availability of mobile devices.

In the past two decades, research into mobile learning has picked up pace, with numerous frameworks for mobile learning being suggested by different groups of researchers. At the same time, multiple reports have shown that there is a gap between the translation and adoption of research results and theories into actual practice in various fields.

This paper attempts to bridge this gap by presenting a novel teaching model that can be introduced between a theoretical framework and the concrete steps that educators can adopt to implement the rich body of research on mobile learning to their own curriculum design.

2. Background

The number of mobile phone users have steadily climbed throughout the years and is expected to exceed 5 billion in 2019 (Meena & Kumar, 2017). Young people has adopted mobile technology so readily that the mobile phone has already become an essential component in their lives (Campbell, 2005), so much so that Ling (2000) even stated that the mobile phone is "at cross purpose with the mission of the school". Forward-looking researchers and institutions have accepted the paradigm shift, and many have embarked on incorporating mobile learning into their curriculum (Kljunić & Vukovac, 2015; Oberer & Erkollar, 2013; Taleb & Sohrabi, 2012; Wang, Shen, Novak & Pan, 2009).

It is Sharples et al. (2009), who have one of the more encompassing definitions of mobile learning. They unpacked mobile learning into 1) mobility in physical space, 2) mobility of technology, 3) mobility in conceptual space, 4) mobility in social space, and lastly 5) learning dispersed over time. Regardless of the definition, it is commonly recognized that mobile learning is a subset of electronic learning (elearning) with its own characteristics and constraints (Parsons & Ryu, 2006).

In the past two decades, research into mobile learning has picked up pace, with numerous frameworks for mobile learning being suggested by different groups of researchers. Koole's (2009) FRAME (Framework for the Rational Analysis of Mobile Education) model "describes mobile learning as a process resulting from the convergence of mobile technologies, human learning capacities, and social interaction."

3. Proposed Quality Dimensions

Using Koole's FRAME model as the framework for choice, we propose two middle layers between the framework and actual practice to facilitate implementation. The layers split rationally into two layers, which also reduces the amount of information included at each layer. In the first layer, we crafted quality dimensions as rhetorical guiding questions that could be mapped from the overlaps between the circles in the FRAME model. As shown in Figure 1, we are using Koole's terminology where the three intersections are abbreviated by the terms DL (Device-Learner intersection), LS (Learner-Social intersection), and DS (Device-Social intersection). These questions were based on multiple research on mobile learning and aim to condense the knowledge and wisdom of these research yet not be too shallow and inflexible.
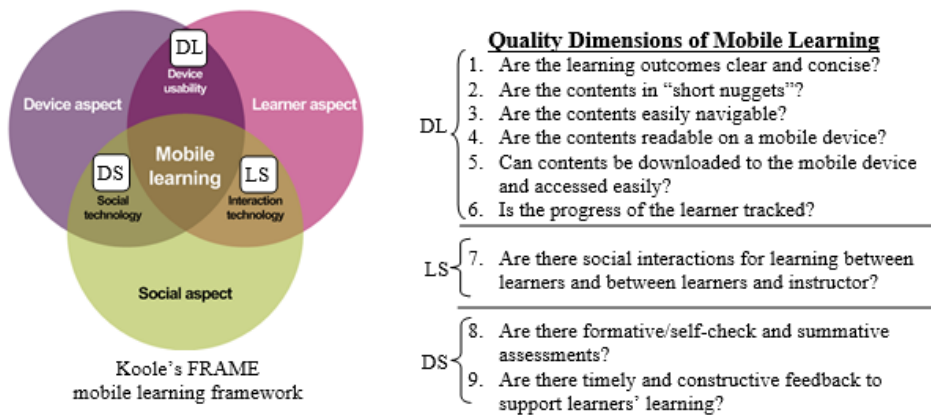
Figure 1. Mapping of Koole's FRAME to Quality Dimensions

These nine questions will provide instructors with rhetorical questions to anchor their design in the theoretical framework. However, taking human behavioural science into consideration, we went one step further to create a mnemonic that gives instructors a "chunked" checklist to use when designing mobile lessons. We term the breakdown of this mnemonic "MOHICANS".

4. Proposed Design Strategies

The design strategies, "MOHICANS", proposed (see Figure 2) are extracted from both Koole's FRAME model as well as the quality dimensions discussed above. The first three design strategies are general design considerations that stem from the FRAME model directly, while the next five strategies are drawn directly from the quality dimensions.
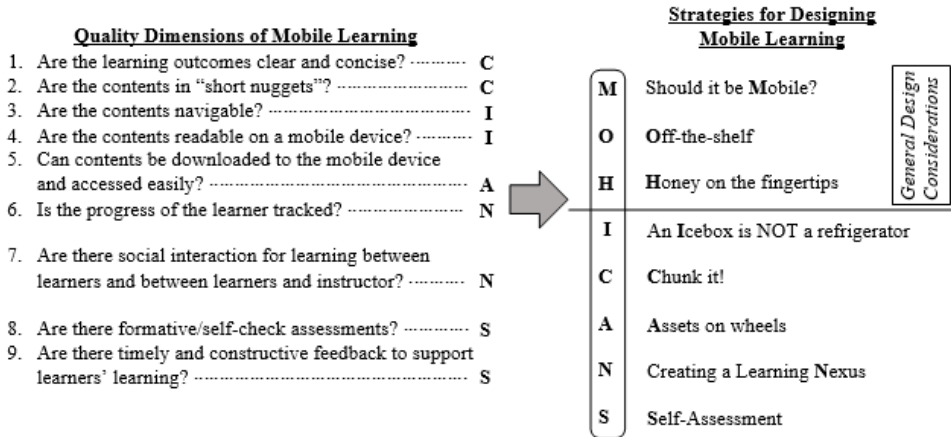
Figure 2. Mapping of Quality Dimensions to Design Strategies

4.1. M is for "Should it be Mobile"

The first general design strategy for instructors will be to consider the most pertinent question: Is it based on a timely topic that learners would like to have a quick refresher on while on-the-go, or would this lesson be better presented if delivered in a device with a larger form factor or in a physical class?

4.2. O is for "Off-the-shelf"

The next general design consideration is for instructors to consider off-the-shelf solutions versus creating materials from scratch. For example, it would be more efficient to curate a publicly available animation that could present the materials in a visually appealing manner, than for the instructor to create a similar animation but at the expense of more time spent.

4.3. H is for "Honey at the fingertips"

The last general design consideration is for instructors to remind themselves to design their mobile lessons to be interactive so as to keep the attention of learners. Instructors would want to design their mobile lesson so that the lesson seems to be like "honey" which learners would like to "taste" from.

4.4. I is for "An Icebox is NOT a refrigerator"

This is the first design strategy drawn from the quality dimensions i.e. dimensions 3 and 4 (readability and navigability). Mobile learning has such distinct features that normal elearning lessons cannot be counted as a model mobile lesson. Instructors can use this visual metaphor for an icebox versus a refrigerator to remind themselves to not confuse desktop elearning with mobile learning.

4.5. C is for "Chunk it!"

To facilitate retention for learners of a mobile lesson, chunking large amount of information into small parts helps people to remember things better. For this reason, mobile lesson designers are reminded to chunk both their learning outcomes and contents into small "nuggets" of information to aid learning, vis-à-vis quality dimensions 1 and 2 respectively.

4.6. A is for "Assets on wheels"

Mobile lessons should be self-contained i.e. each lesson should have learning outcomes that are taught via mobile-enabled learning activities and finally assessed at the end of the lesson. This would allow each mobile lesson to be accessed in a non-linear manner, in line with the concept of "just-in-time" learning.

4.7. N is for "Creating a Learning Nexus"

With regards to quality dimensions 6 and 7, which suggest respectively that the learner's progress be tracked and social interaction for learning be introduced, we recommend that the mobile lesson be integrated into a Learning Management System (LMS) to tap on the LMS's in-built login system, discussion forum etc.

4.8. S is for "Self-Assessment"

Lastly, quality dimensions 8 (assessment) and 9 (timely feedback) are mapped unto the strategy of self-assessment. Mobile lessons should have both in-content mid-lesson quizzes for knowledge checks, as well as summative assessments to gauge the overall learning outcomes of the learners.

5. Methods

Participants in the present study consisted of 120 identified learners from 2 faculties namely, School of Information Technology and School of Health Sciences. The participating instructors designed their mobile learning contents in accordance to the mobile learning teaching model that was highlighted in this paper. The learning contents were developed using various tools that support mobile learning. This study aims to find out how quality dimensions and strategies can enhance the quality of learners' learning. Each learner was surveyed to answer the following questions:

1. The learning outcomes are clear and concise.

2. The content is bite-sized for learning on-the-go.

3. The content is easily navigable.

4. The content is readable on a smart device.

5.   The content helped me in fulfilling the assessment required for this topic.

6.   There are timely and constructive feedback to support learning.

7.   The mobile learning contents have been helpful to me in my learning.

8.   The mobile learning contents are self-paced, self-directed and relevant.

9.   Overall, I find that mobile learning is good way of learning for me.

Besides the survey results from the learners, the authors examined the module learning outcomes through classroom observations coupled with discussion with the instructors to gauge the level of instructors' satisfaction as well as the level of attainment learners achieved in the required competencies.

6. Results and Discussion

In this section, we will discuss the results that was derived from the methods that were explained above. The results from the survey shows that the learners felt that mobile learning has helped them in their learning. Results has also shown that 90% of the learners felt that the mobile learning is good way of learning for them.

The following are the key results of the responses collected from the survey.
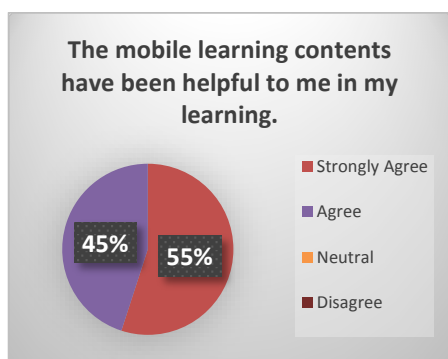
Figure 3: The mobile learning contents have been helpful to me in my learning.	*Figure 4: The mobile learning contents are self-paced, self-directed and relevant.*
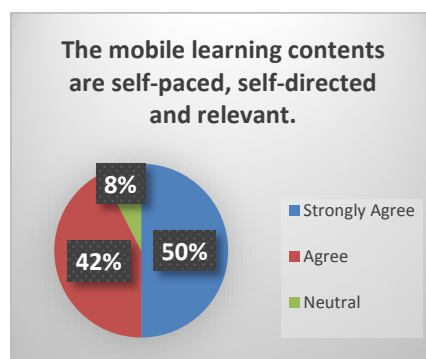
Table 1. Principle Results of Mobile Learning

Overall, I find that mobile learning is good way of learning for me	Percentage (%)
Strongly Agree	42
Agree	48
Neutral	10
Disagree	0
Strongly Disagree	0

Both qualitative data and sentiments collected from survey and classroom observations have been encouraging. Sediments from the feedback gathered have indicated that the positive acceptance of the proposed teaching and learning model by both the learners and instructors.

Analysis of the collected data give suggestion that mobile learning was effective than the use of traditional teaching pedagogy to achieve the learning outcomes of the topics that the contents are developed in mobile learning packages. Results have also suggested that by using these quality dimensions and design strategies dedicated for developing mobile learning content, there is an increase of interest in learners' learning and has enriched the learners' experience. The instructors have also feedback that the teaching model and mnemonic MOHICANS have provided them practical design strategies that helped them to design learning contents suitable for mobile learning. From the score that the learners have achieved in the summative assessment, it can be determined that the learners have achieved the learning outcomes desired of the mobile learning contents. Most of the learners are able to score above 80% after going through the mobile learning contents.

7. Conclusions and Recommendations

Research has shown that the learner's experience on a mobile device is very different from any other traditional eLearning platforms (e.g. desktop). We have proposed a specialized design model for mobile learning. This study has proposed a 2-middle-layer-approach built upon Koole's FRAME model with quality dimensions (1st layer) and strategies (2nd layer) that lead to a sound mobile lesson design. The results collected from the survey demonstrated the effectiveness of the recommended model.

The present study is administered to analyze the advantages of using design strategies that was recommended in the mobile learning model. The outcome is measured from the learner and instructor perspective. Quantitative feedback are collected through survey conducted with the 120 learners. 6 instructors are requested to develop mobile learning content based

on the quality dimensions recommended for the modules that they teach respectively. 120 learners from 2 faculty contributed to the survey results. Qualitative feedback are also collected from the instructors through classroom observations and interviews. Overall, the survey has shown more than 85% of the respondents responded with 'Strong Agree' or 'Agree' for each question. Therefore, the summarized findings of this study reveal that our proposed approach maybe effective and practical for learners learning on-the-go, anytime and anywhere.

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Online short course for learning management system training in an African university of technology

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Abstract

With the use of technology in the classroom growing every year, lecturers are expected to blend facilitations by making use of learning management systems. At the Central University of Technology, Free State this poses a problem for the learning designers in charge of training lecturers in educational technologies as there is limited space and time to not only teach lecturers the skills, but also to apply them in their own contexts. The purpose of this paper is to present participant perspectives of an online short course in which they learned how to use Blackboard and other educational technologies needed for blending teaching and learning. An exploratory design was implemented with descriptive statistics involving quantitative analysis of the collected data to determine the participants' perspective on their skills gained. An online survey tool was used to collect the data. Eighty-four percent of particpants felt that they were able to communicate via the system's announcements, 82% felt confident that they would be able to customize the space and 94% felt that they were now able to add content, such as files. When asked if they felt like they learned the skills they expected from the online course, 94% of particpants replied positively.

Keywords: e-learning; learning management system; Blackboard; instructional design; online course; educational technology.

1. Introduction

The advancement of educational technology has created a need for lecturers to shift the classroom. Whether a course is completely online or a blend between online and face-to-face (f2f) , the benefits of a learning management system (LMS) in today's university environment are endless. At the Central University of Technology (CUT), Free State it is important for lecturers to master the LMS so that they may provide their students with the best facilitation possible. In an increasingly virtual world the need for rapid communication and continuous information flow is critical (Lee & Owens, 2000) which means to prepare students for this new world the training of lecturers in all educational technology, especially the LMS is of paramount importance. Training of these lecturers come with a plethora of challenges that fall in the capable hands of the institution's e-learning team.

Traditionally the e-learning team at CUT would invite lecturers to f2f training sessions facilitated in a computer lab where participants can actively follow along. Two main issues stem from this approach. The first is that lecturers' time schedules are inconsistent and fixing an appropriate time that suits a large group of people is tricky. The second is that lecturers only learn the skills of the LMS at these sessions not how to apply them to their own contexts. The result being that lecturers do not benefit fully from these training sessions which leads to frustration and negativity toward the LMS. A means of training lecturers to not only use the tools of the LMS, but also learn how to apply those tools in their own contexts was necessary, but that was also convenient for all no matter their time schedule.

The question guiding this paper was focused on combining access and application. How can training of the LMS be conducted that benefits all? The aim was to develop an online short course where lecturers participate in their own time that not only facilitates the acquisition of skills, but also allows an experience of the online space as a student and apply the skills learned in a space provided where constructive feedback and peer learning can take place.

The purpose of this paper is to present perspectives of participants completing an online short course designed to be completed asynchronously with a space where new skills can be practiced. Literature underpinning the research will be discussed followed by the context of the study. The online course will be described, and participants' perspectives presented. Finally, the efficacy of this type of training in the higher education setting will be argued.

2. Literature review

F2F learning is when teaching and learning is facilitated while the lecturer and students share the same geographical location where in contrast, online learning occurs on a digital

medium where parties work synchronously or asynchronously from anywhere. Blended learning is an approach that includes a combination of online and f2f teaching and learning experiences. Blended learning will take place in both the classroom and online with the lecturer exercising some control over the time and pace of learning (Pullman & Graham, 2018). To facilitate blended learning, an LMS can be used to host the online material and activities.

An LMS is an information system that facilitates e-learning (McGill & Klobas, 2009) which means any teaching and learning experience that is supported by information technology. There are two main types of LMSs namely; commercial and open source (Beatty & Ulasewicz, 2006). A commercial LMS will be distributed, hosted and supported by its owner company. An open source LMS is free to use, but the maintenance and support falls to the user. In the university setting, LMSs are used to create an online space where students can interact with content, lecturers and peers as well as online assessments and feedback. LMSs are generally managed by the Academic Support section, generally the e-learning unit.

3. Context

In charge of support for academic staff at the CUT is the Centre for Innovation in Learning and Teaching (CILT). The purpose of CILT is to foster staff development and drive research in learning and teaching practice. There are five units within CILT of which e-Learning and Educational Technology is the unit responsible for all e-learning and technology support on and off campus which includes managing and providing support for the LMS.

The CUT makes use of the commercial LMS software package, Blackboard Learn 9.1, distributed by Blackboard Inc. Training on the system is facilitated by the two learning designers and conducted f2f in a computer lab with 20 or less participants at a time. The space limitation means multiple sessions must be set up to accommodate lecturers who have different schedules. Lastly, lecturers are not prone to immediately hone the new skills they learned at the training session as they did not learn to apply the skills in their contexts but merely to perform them. A more ideal method for training should not only teach the skills, but allow participants to actively apply them when it's still fresh as well as provide open access of the same training to all (Osuna-Acedo & Gil-Quintana, 2017).

4. Online course

The purpose of the online course was to not only prepare lecturers for online delivery, but also to foster a network and culture of online learning on campus.

The course covered the basics of Blackboard and at the end participants will be able to:

- Navigate the LMS interface by designing an effective user experience on Blackboard
- Communicate information to students by creating announcements, sending mails and facilitating discussion boards
- Build content by uploading files, creating learning activities and tool links
- Manage the LMS by enrolling students, creating calendar events and personalising settings.

The course took place over three weeks with the following being covered each week:

Table 1. Layout of online short course structure

Week 1	Week 2	Week 3
This week provides participants the time to get used to the system and explore some of the tools. During this time everyone gets to know each other on a shared digital pin-up board (Padlet) and participate in an ice breaker game in the discussion forums. Participants then personalize their settings by updating their personal information and uploading an avatar. The week is wrapped up with a discussion on making the online environment friendlier for students.	During Week 2 participants enrol themselves into groups and each group is allocated a practice page where they are enrolled as instructors. They send announcements and organize the course menus on the practice pages. Skills learned during this week also include using the formatting palette to edit type, embed images and videos and link to websites.	In Week 3 participants start building content on their pages as well as explore learning theories for online delivery. They use Google's Docs word processing and Coggle mindmap tools to create a shared document with specific outcomes and design a lesson using Gagne's Steps of Instruction respectively.

This course takes a very active hands-on approach and participants learn by doing as well as from peers during interactive discussion sessions. So particpants experienced an online course, hosted on the LMS exactly as their students would. This lets them learn as much by experience as from he instructor.

5. Methodology

An exploratory design was implemented involving quantitative descriptive analysis of the collected data to determine the participants' perspective on their skills gained during the online course. An exploratory design aims to develop insight into a phenomenon which is not well understood (De Vos *et al.*, 2011), while a descriptive analysis requires that the

researcher remains focused on what is given so that the experience of the phenomenon, as well as the structure of that experience can be discovered (Foster, 2016). An online survey tool, QuestionPro, was used to collect the data after each iteration was complete. Getting feedback from the participants of an online course is one of the success factors for online course delivery (Stevens, 2013). It allows instructional designers to hone best practices and gain insights from feedback to supplement other research results.

The target population of the study was the 63 participants who graduated one of the five iterations of the online course conducted between 2017 and 2018. For 3 weeks partipants completed daily activities that guided them to a new skill or tool every day. At the end of the 3-week period, graduates were encouraged to complete a feedback survey that focused on the participants' expectations of the course, whether those expectations were met, and the skills learned. The skills learned were determined by a five-point Likert scale that ranged from 1 star being *The Horror!* to 5 stars being *Next Level Ninja!* The skills questioned were aligned with those in the outcomes that were shared with participants at the commencement of the online course. Deeper knowledge was explored with questions regarding the participants' experience navigating the course, the usefulness of daily announcements and instructional videos and whether they would be able to incorporate their new skills into their daily practice.

Using the outcomes of the online course to guide the formulating of the questions strengthens the content validity of the questionnaire, ensuring the domain is adequately covered (Bolarinwa, 2015). Close- and open-ended questions were asked to maintain a balance between data that can be analysed, but also allowing deeper responses with free-form answers (De Vos *et al.*, 2011).

6. Results

Thirty-three participants completed the questionnaire and their responses showed the following key results:

When asked if they felt like they learned the skills they expected from the online course, 94% of participants replied positively (70% Absolutely and 24% Most of the skills).

Participants were then asked about their perception of the level of the skills they learned by indicating in a Likert scale from 1 star being the lowest amount of skills attained and 5 stars being the highest. The questions were divided into the categories Communication, Navigation and Content Building for ease of presentation, with the former being discussed first.

Most of the participants, 84%, felt that they achieved a high level (72% 5 stars & 12% 4 stars) of skill when sending announcements via the LMS. Eighty-five percent of

participants felt that they were able to send emails via the LMS (61% 5 stars & 24% 4 stars). When participating in discussion boards, 79% (49% 5 stars & 30% 4 stars) felt that they have mastered the skill and 57% (42% 5 stars & 15 % 4 stars) felt confident that they would be able to create and facilitate a discussion board.
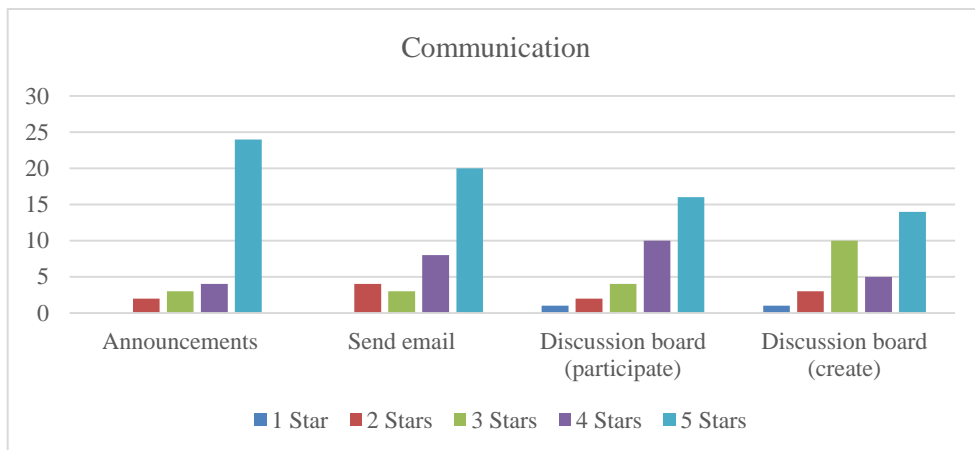
Figure 1. Participants' perspectives on level of communication skills gained

When focusing on navigational skills, the participants' responses indicated that 82% felt that they could confidently customize their personal settings on the LMS (64% 5 stars & 18% 4 stars) and 63% (42% 5 stars & 21% 4 stars) felt comfortable working with the groups feature. When exploring the content editor 85% of participants felt that they have got the skills to use this tool beneficially (61% 5 stars & 24% 4 stars).
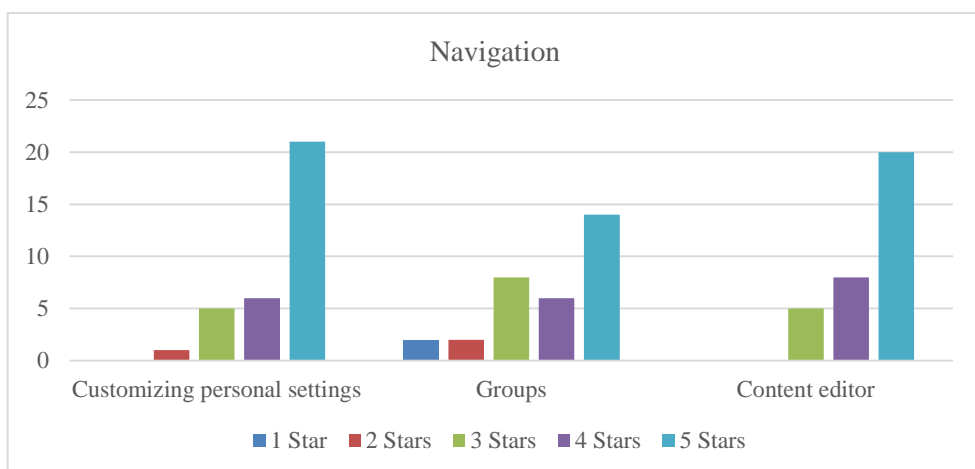
Figure 2. Participants' perspectives on level of navigation skills gained

During the content building skills section, participants felt very positive toward adding files (94%), images (85%) and videos (82%). The final skill, blogs, received a more lukewarm response as only 27% of participants selected 5 stars and 30 % 4 stars. Although 57% still indicates a majority it is perceptibly less than the other skills.
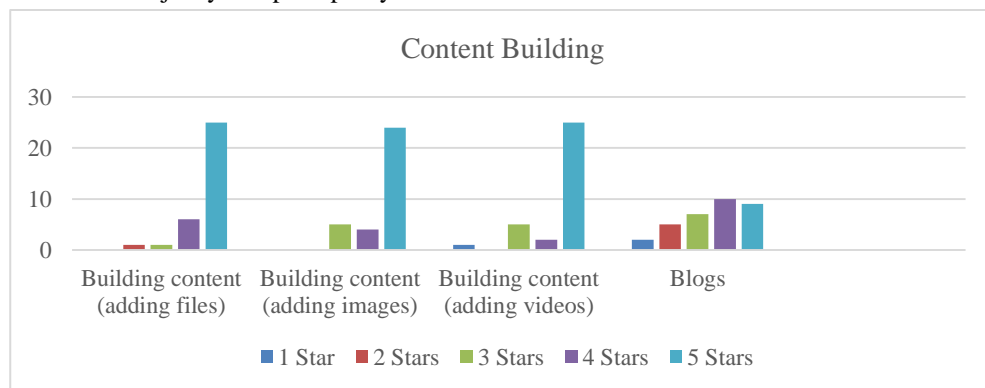
Figure 3. Participants' perspectives on level of content building skills gained

Participants were then asked if they felt they would be able to use the new skills in their teaching and learning practice. They were given the options *Definitely!, Nope* or *I didn't manage to learn the skills, but I'm sure they would've been useful*. A hundred percent of participants selected *Definitely!* which indicates the online course successfully met its outcomes.

During the open-ended questions most of the participants felt positive about their experience and felt that it met their expectations with one participant saying: *"Gagne's theory of learning instruction is one of the things I am going to use, I can already see how it is going to help my students to deal with difficult concepts in microbiology. This theory not only allows you to unpack the concepts, but gives me the opportunity to determine if students are learning. Thinking about threshold concepts in my field I can already see how I am going to unpack them to my students, I am excited, I can't wait to do this!"* another said: *"When I heard "101" I thought it would be a lot more basic and perhaps a waste of time. I was pleasantly surprised!"*.

7. Conclusion

This paper aimed to show that an online short course can help lecturers at a university of technology gain the skills necessary to operate the LMS in a way that allows students to reach the intended outcomes. The results showed that participants of the online short course had a positive experience and felt that they were better able to communicate, navigate and build content on the LMS. Of the 63 graduates of 5 iterations of the online short course, 33 completed the feedback survey. These results showed that 84% felt that they can

communicate via announcements, 85% via email and 79% via discussion boards. When navigating the LMS, 82% were able to customize their personal settings after the course, 63% use the groups feature and 85% edit content using the formatting box. During the content building skills section, 94% of participants felt very positive toward adding files as well as images (85%) and videos (82%). Only 57% of participants felt that they have mastered the blogs tool which indicates an area for improvement.

This online short course assists the e-learning department in training lecturers in the use of the LMS and other educational technologies especially as it caters for different time schedules and geographical locations. There is also no limit on the number of participants so more lecturers can be trained at a time than the current method where the capacity of the training venue determines the number of participants. The course also provides participants with a social network which is important as we are social creatures (Camarero Cano, 2015).

A follow up to this course that delves deeper into the more intermediate functions of the LMS can help further train lecturers to level up their blended and online learning skills especially the online assessment skills.

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A qualitative analysis of student experiences of a blended learning course

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Abstract

Blended learning has become a popular topic in higher education. A blended learning course combines face-to-face instructions with computer-mediated instructions in any possible ratio. Even though studies have investigated effects of blended learning on education costs and student performance, not much is known about how students experience a blended learning course. The current study provides insights into student experiences in a blended learning course in which all materials were available online, and a minimum number of face-to-face meetings was organized. Three students of the course participated in an in-depth interview, and all fourteen students of the course provided answers to questions during four face-to-face tutorials. Findings indicate similarities in their needs, but differences in their perception of the flexibility that was given to them in the course. A possible explanation for the differences in perception of flexibility could be the students' self-efficacy. Future studies should be designed to investigate which factors contribute to a positive student experience of blended learning.

Keywords: *Blended learning; Student experiences; Interviews; Flexibility; Self-efficacy.*

1. Introduction

In 2003, blended learning emerged in the industry of knowledge delivery (Rooney, 2003). The rapid growth of digital technology (Bonk & Graham, 2006) as well as the need for more cost-effective and efficient learning environments (Selim, 2007) quickly increased the popularity of blended learning. Bonk and Graham (2006) describe blended learning as a system in which face-to-face instruction is combined with computer-mediated instruction. Face-to-face learning is considered as traditional learning, involving interactions between a teacher and students in a live physical synchronous environment. In contrast, computer-mediated learning is based on a distributed learning system, emphasizing self-paced learning in an asynchronous, low fidelity environment (Bonk & Graham, 2006).

Dean, Stahl, Sylwester and Peat (2001) explored the effectiveness of a specific distance education program for physicians at the University of Tennessee. This program was considered a blended learning program since it used a mixed-mode delivery of information. The program was completed in half of the time at less than half of the costs than a traditional program, and it contributed to positive learning outcomes (Dean et al., 2001). A meta-analysis regarding the effectiveness of online and blended learning showed a significant increase in performance with blended learning compared to face-to-face learning (Means, Toyama, Murphy, and Baki, 2013). These findings should however be interpreted with caution, because blended learning tends to be paired with additional learning time, instructional resources, and encouragement of interaction among learners, which was not controlled for in the study (Means et al., 2013).

While the benefits in terms of cost-effectiveness and student performance are promising, it is equally important to also optimize student satisfaction with blended learning. Some studies investigated students' acceptance of blended learning (e.g., Yeou, 2016) or their satisfaction with it (e.g., Bentley, Selassie, & Parkin, 2012). Other studies investigated students' opinions about blended learning courses (Pfennig, 2017) and engagement in terms of participation (Kritzinger, Lemmens, & Potgieter, 2018). Not much is known however about how students *experience* blended learning courses.

To fill this gap, a study was designed to investigate student experiences with a blended learning course, and define crucial success factors and barriers of blended learning from a student perspective. The framework that was used to investigate student experiences was the Technology Acceptance Model (TAM) as introduced by Davis (1989). This model describes fundamental factors that determine acceptance of technology, and can easily be adapted to fit the context of a blended learning course. Following this model, students of a blended learning course were interviewed with the goal to gain insights in perceived usefulness, perceived ease of use, attitude, intention to use, and actual use of the blended learning course.

2. Method

2.1. Participants and Design

Three students following the blended learning course Behavioral Research Methods I during educational year 2017-2018 (PP 1-3) were asked to participate in an in-depth interview concerning their experiences with the blended learning course. All three of them were female, with an age ranging from 21 to 30 years (M = 24.7, SD = 4.73). In addition, all fourteen students of the course were asked during each of four face-to-face tutorials to fill in a so-called one-minute paper: a sheet with three questions concerning their current thoughts about the blended learning course.

2.2. Materials and Procedure

Semi-structured interviews were performed by a researcher other than the teacher of the course, via Skype. In the interviews, students answered questions about their experiences with the blended learning course they were following at that time. The interview questions were largely based on TAM (Davis, 1989), were modified to open questions, and adapted to the blended learning course. Questions reflected the perceived usefulness of a blended learning course, the perceived ease of use of the Learning Management System (LMS) that was used for the course, the attitude students had towards the course, the intention to participate in other blended learning courses, and which factors are important to make a blended learning course successful.

2.3. Data analysis

The interviews were transcribed instantly and analyzed following the guidelines of thematic analysis (Braun & Clarke, 2006). This analysis was iterative, in which the data was reviewed multiple times, and themes were checked against the collected data in both the interviews and the one-minute papers.

3. Results

The transcribed interviews were summarized and coded, and codes were categorized into five themes: easy information access, need for face-to-face interaction, need for clear expectation management, flexibility as a liability, and flexibility as an asset. Interestingly, students mostly agreed about the needs they had regarding blended learning, but they differed in their experiences regarding the flexibility of the course. All themes and subthemes are visualized in Figure 1, and they are discussed in detail in the subsections below. The last part of this section explores whether differences in students' performance occurred between the course as a traditional classroom course and a blended course.
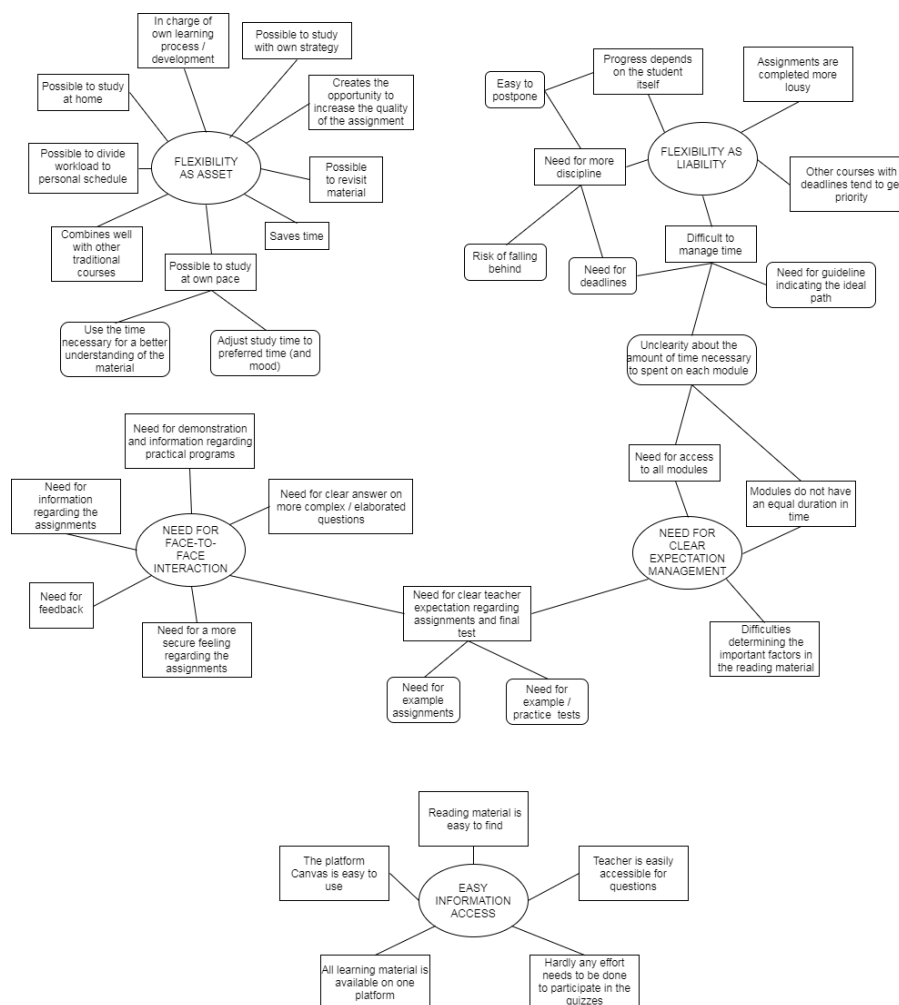
Figure 1. Overview of the relationship between themes and subthemes found in the interviews.

3.1. Easy information access

Students indicated that it was easy to find and retrieve information from the LMS. Having all information on one platform was considered to contribute to the ease of use of the blended learning course. In contrast to traditional courses in which learning material is usually provided through multiple different means, information being presented on one platform was considered as more efficient. One student stated: '*You will get [to the quiz] automatically, there is nothing you have to do. You just click "next" and you will get the next question*' [PP1], showing that having a sequential order of information and tasks on the platform is experienced as an asset of blended learning.

3.2. Need for face-to-face interaction

Despite the positive experiences with the LMS guiding students through the course, students still indicate a need for face-to-face interaction. According to the students, this face-to-face interaction would make them more informed and secure about the assignments in the course. Students also indicated that having the opportunity to have face-to-face interactions with the teacher motivates them. As one student put it: '*[I would like to have] one-to-one interaction with the teacher really in front of you. That works so much better for me. Then I get more motivated externally*' [PP3].

Another reason for having face-to-face meetings is that students struggled with their understanding of how the statistical analysis program worked. A need for demonstrations was mentioned multiple times in the interviews. Of course, these demonstrations could be provided through other means than face-to-face interactions.

3.3. Need for clear expectation management

One aspect that was mentioned by all three students in the interviews was that they would like to have more information regarding the time necessary for the separate elements of the course. When students are responsible for planning activities in the course independently, they would benefit from information regarding the expected duration of each task. One of the students explained the struggle she had with planning and how that led to motivational difficulties: '*At the beginning [of the course] I knew that there were ten modules, so I planned to make one every week. However, the size of the modules differed so much. Assignment 1 was only an hour and another [assignment] five hours. So I put the rest [of the course] on a low level*' [PP3].

In addition to problems with time management, students also mentioned a lack of clarity about the expected quality of their assignments. They did not see opportunities for discussing this issue with the teacher of the course. One student indicated this by stating: '*Regarding the assignments, it was sometimes difficult to know what was asked from us. Maybe that giving examples is a good idea, so that we can see something of what is expected from you, instead of figuring it out yourself*' [PP2]. The question remains what the best way is to assist students with this if there is no face-to-face contact.

3.4. Flexibility as a liability

Organizing a blended learning course allows students to study at their own pace, but a problem that was mentioned about this flexibility was that students experienced a lack of external pressure for finishing assignments. This could lead to procrastination, as one student mentioned: '*You really need to have discipline to do it. So if you do not feel like it, it becomes very easy to do nothing. That is one of the risks of blended learning*' [PP2]. Due to the lack

of external pressure in the blended learning course, other courses which do comply with this external pressure and have deadlines, tend to be prioritized over the blended learning course.

There were no deadlines in the blended learning course other than finishing all the work before the exam period, resulting in difficulties related to time management. Students indicated a need for stricter deadlines or guidelines that provides students with an example planning. One student proposed the following solution: '*What I would like more is that I can see what part of the work I already completed. A kind of loading bar per module, that you will see "hey, you have 80% of the work completed", or something*' [PP1].

3.5. Flexibility as an asset

Interestingly, flexibility was also seen as an asset. Students appreciated the possibility to work on the course in their own pace, and that they could decide when to work on the course (rather than having fixed lecture hours). One of the students stated that: '*It gives me the opportunity to plan for myself when I do something [for the course]. Because I plan for myself, I know when I have time to do something. So now I can focus whenever I have motivation. When someone obliges me to focus, then it will not work*' [PP2].

Additionally, students mentioned that studying at their own pace created an opportunity to use the time necessary to understand the learning material better. As one student put it: '*If you get explanation [of the learning material] you will absorb [the material] less well than going through [the material] yourself*' [PP2]. The flexibility thus allowed students to be more in charge of their own learning process, which was experienced very positively.

An important insight is that a blended learning course can be combined well with traditional courses: '*We have two other courses. I liked it that one of them was a blended learning course*' [PP1]. This shows that blended learning courses can be used in educational programs, as long as there are still traditional classroom courses as well.

3.6. Student performance

In addition to student experiences, we analyzed whether there was a difference in student performance between the blended learning course and the same course given to 10 students in a traditional classroom setting in 2016-2017. No significant difference in final grade of the course was found between year 2016-2017 ($M = 6.42$, $SD = 1.72$) and year 2017-2018 ($M = 6.91$, $SD = 0.82$), $t(22) = 0.94$, $p = 0.36$. This result shows that changing the course into a blended learning course did not significantly influence overall student performance.

4. Discussion

A study was performed to investigate students' experiences of a blended learning course. Three students of the course were interviewed, and all fourteen students filled in one-minute

papers throughout the course. A thematic analysis revealed five main themes. Students had similar needs regarding face-to-face interactions and knowing what was expected from them in the course, and the current set-up did not fulfill those needs. Earlier work also showed that students do not believe that online tutorials could or should replace face-to-face tutorials (Sweeney, O'donoghue, & Whitehead, 2004), but students in the current study indicated that face-to-face interactions are mostly needed for grasping specific knowledge. Students in the current study were uncertain about the amount of time they had to spend on each module, leading to difficulties in their time management. Providing insights into the modules from the beginning of the course or providing a course planning to the students might give them a stronger feeling of control, and allows them to plan their activities more accurately.

Students differed in the extent to which they liked the flexibility in the course. Positive aspects of the flexibility that was offered were the possibility to study at their own pace, being in charge of one's own learning process, and the possibility to work on all aspects of the course from home. However, too much flexibility in the course has negative effects as well. Students experienced a lack of external pressure, found it difficult to allocate time to the course, and partly lost their motivation to study. This shows the importance of proper communication about what is expected from students, but also may indicate that different students need a different approach.

Research in the learning domain indicates that differences in student learning and academic achievement might be explained by self-efficacy. Students with a higher level of perceived self-efficacy set both higher and more productive mastery goals (Walker & Greene, 2009), and choose to engage in tasks which are more challenging (Bandura, 1993; Bandura & Schunk, 1981). This may make those students more likely to thrive from flexibility, whereas students low in self-efficacy may perceive flexibility as a liability. The current study did not measure self-efficacy, so there is no way of knowing whether this explains the current findings. Future work should therefore be designed to investigate the relationship between self-efficacy and students' perception of flexibility in blended learning courses.

When comparing the average course grades of the same course in a traditional classroom setting with a blended learning version, no statistical differences were found in student performance. However, the average grade of students in the bleded learning course was almost half a point higher. In order to find out whether students in a blended learning course indeed significantly outperform students in a traditional course, further research should be conducted in which performance in students is examined with larger samples.

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Using Padlet for collaborative learning

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Abstract

Technology-based collaborative learning is attaining increasing relevance in higher education. Despite the considerable number of tools and online applications that support collaborative learning, their adoption in classroom courses is still in its early stages. This paper focuses on Padlet and presents some of the uses of this web application that support collaborative learning in classroom teaching. In particular, we summarize the process of collaborative learning through Padlet in the Master's Degree for Secondary Education, Vocational Training and Language Teaching. The uses of Padlet can be summarized in six: research resource gathering, class resources, class diary, FAQ, brainstorming, online dialogue.

Keywords: Collaborative learning; Padlet; Multimedia wall.

1. Introduction

Technology-based collaborative learning is attaining increasing relevance in higher education for a number of reasons, such as the prevalence of constructivism as a teaching and learning approach or the need to increase student engagement, among others. Online collaborative learning can be defined as a learning process in which students work together to analyze a question or create shared meaning (Harasim et al., 1995). This is a process characterized by a number of features, such as the active nature of learning, the role of the teacher as a facilitator of students' learning and the increased students' responsibility for their own learning (Kirschner, 2001). Nowadays, there is a significant number of tools and online applications that support collaborative learning (e.g. Google web applications, Edmodo, Facebook, etc.) but their adoption in classroom courses is still in its early stages (Hsu et al., 2014).

This paper focuses on Padlet and presents some of the uses of this web application that support collaborative learning in higher education. In particular, we summarize the process of collaborative learning through Padlet in the Master's Degree for Secondary Education, Vocational Training and Language Teaching at University Jaume I (Spain). One of the primary purposes of this Master's Degree is to shape the idea that teaching is a thoughtful process and that future teachers should introduce reflection in their daily activities (i.e. they should not act based on impulse or intuition) and that they need to interact with other teachers to improve the quality of their teaching. We believe that in this context, collaborative learning may help students to retain information, increase their motivation and improve critical thinking skills (Cavanagh, 2011) all of which are of crucial value for future teachers.

2. Uses of Padlet for collaborative learning

According to Resta and Laferrière (2007) there are four instructional motives that justify the use of technology as a way of introducing collaborative learning in the classroom (Figure 1).
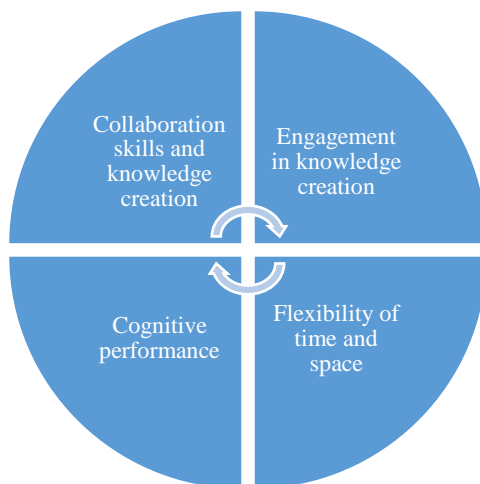
Figure 1. Instructional motives for the use of technology in collaborative learning. Source: own elaboration based on Resta and Laferrière (2007).

First, it helps students to be ready for the knowledge society by increasing their collaboration skills and knowledge creation. Second, it contributes to enhance students' cognitive performance and to promote deep understandings of key concepts. Third, it provides the teaching process with higher flexibility of time and space for collaborative learning and fourth, it promotes students' engagement in knowledge creation. Bearing these motives in mind, we structured the teaching process in the Master's Degree using Padlet.

Padlet (www.padlet.com) is a free multimedia wall that allows real-time interaction both among students and between the students and the teacher and that facilitates whole-class participation (Fuchs, 2014). An increasing number of teachers during recent years has recognized that Padlet is a useful tool to improve collaborative learning. Some of its advantages are: a) easy to use, b) instant collaboration (any student can see when anyone else is uploading something in the wall), c) multimedia (almost everything can be placed on the Padlet) and d) mobile (it can work on many different devices) (Zhi and Su, 2015). Its applications in the classroom are endless, from a tool to evaluate lessons until a way of asking for ideas. In addition, files from the Padlet walls can be saved and copied into any other application. Padlet can be used for simple tasks or for expert teaching and it does not require special training or experience in the use of web 2.0 tools (Weller, 2013). Based on the model summarized in Figure 1, six applications of Padlet were crucial during the teaching process of the Master's Degree, namely research resource gathering, class resources, class diary, FAQ (frequently asked questions), brainstorming and online

dialogue (Figure 2). In our opinion, these applications contribute to the four instructional motives that we described above.
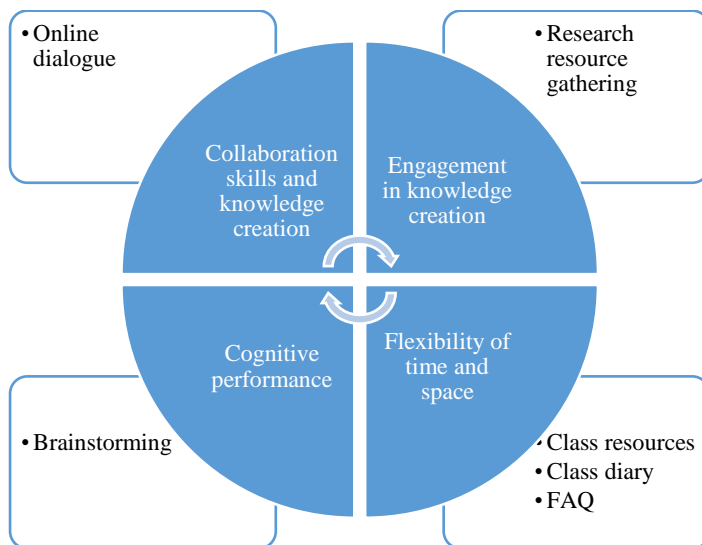
Figure 2. Uses of Padlet. Source: own elaboration.

2.1. Research resource gathering

Students in the Master's Degree for Secondary Education, Vocational Training and Language Teaching should be familiar with innovative teaching techniques. One of the aims of our course is to motivate students to introduce innovative teaching and learning procedures as a way of increasing the engagement of their future students in the secondary and vocational schools. Innovation skills should be present in secondary teachers but innovation requires, as a first step, to know and understand innovative methodologies. Therefore, it is essential that our students in the Master's Degree assimilate the wide array of innovative teaching methods that can be used in the classroom, together with their advantages and disadvantages. For this reason, we asked our students in the Master's Degree to create an Innovative Teaching Padlet to hold ideas, sources and descriptions of several innovative teaching methodologies. This Padlet constitutes the virtual book of our course and has been created through the collaboration of all the students. In addition, Padlet forces students to summarize ideas and write something concise, which also contributes to their learning. The content and structure of the Innovative Teaching Padlet varies from year to year, depending on the interests and motivations of the students (Figure 3).

Figure 3. The Innovative Teaching Padlet

2.2. Class resources

Any type of file can be posted on Padlet and it can be viewed instantly on the wall so it provides a valuable way to compile teaching resources. In doing so, we created as many Padlets as classroom sessions we had with the students and we inserted hyperlinks in the corresponding calendar (Figure 4). Then, the teacher and the students placed the videos, documents and images that were used during the lessons in the corresponding Padlet. The students could read and download the resources directly from the wall.
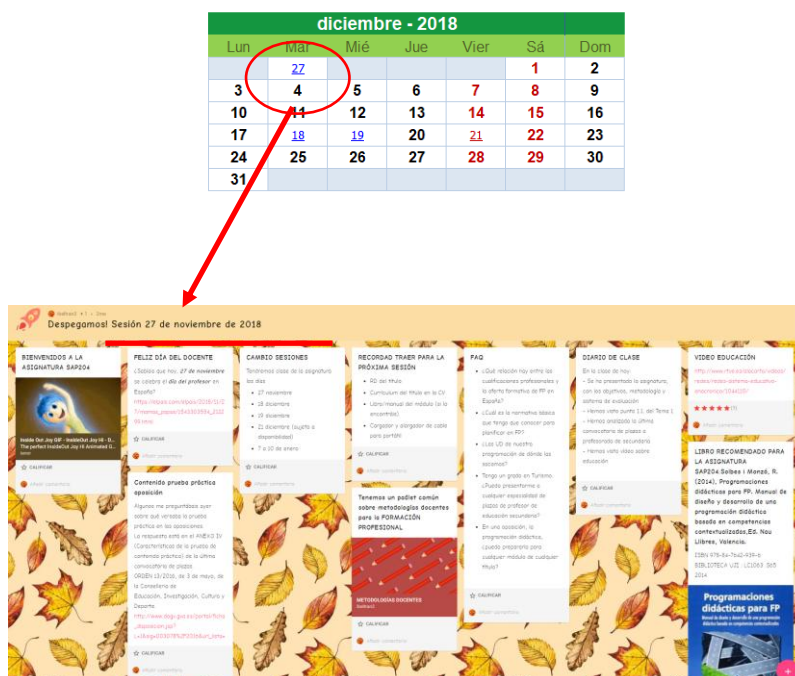
Figure 4. Class resources in Padlet.

2.3. Class diary

A class diary is a report created immediately after each session that includes a summary of the session and qualitative data about the teaching process. We proposed our students to work in small groups (5 people maximum). Each group was responsible for the class diary of a session (Figure 5). The benefits of this diary are twofold. On the one hand, it provides the teacher with valuable information about the development of the sessions: how did the students feel? what did they get out of the session? does the teacher need to explain anything again?, etc. On the other hand, it allows students that could not attend the session to check the progresses made in the class.

Figure 5. Class diary in Padlet.

2.4. Frequently asked questions

We also created a section entitled "FAQ" with the answers to some of the most relevant questions that arose during the session. The teacher was the responsible for this section by including short and clear answers to the students' concerns (e.g. how many questions will the exam have?).

2.5. Brainstorming

Padlet is a suitable tool for brainstorming because it provides an easy and quick way to place the students' ideas on the wall. It also allows archiving brainstorming ideas and using them when needed. Padlet allows the student's postings to been viewed simultaneously by other students thus contributing to the generation of new ideas. In our case, we decided that the contributions to the wall were anonymous in order to motivate the students' participation in the task. For example, in our course, we used Padlet to generate ideas about

the current education system based on a video by Ken Robinson. Students could individually add their thoughts to the wall at the same time other students were contributing with their ideas. We also asked these students to work in small groups to analyze the ideas from everyone in the classroom.

2.6. Online dialogue

Padlet also allows to conduct an interactive debate among students. Padlet offers different collaboration options, such as the possibility to insert comments on others' posts or to react with a voting system (Figure 6). These options provide opportunities for online dialogue and even for peer-assessment because students have immediate access to the reactions of their classmates to their contributions in the wall.
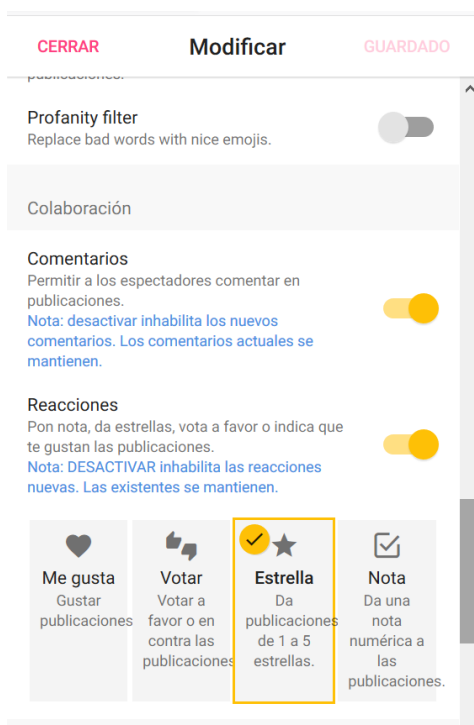
Figure 6. Online dialogue options in Padlet.

3. Results

The result of the activities described in the previous section was a digital repository of material and guidelines of the subject. This repository is *dynamic*, since each year, the content of Padlet may be different and it is *cumulative*, because students can have access to the content included in Padlets built in the past. As regards students' satisfaction with

Padlet, we used a survey to assess the students' opinions. In doing so, we used Kleinsmith's (2017) scale, made up of 8 items assessed with a 5-point Likert scale (agreement/disagreement). We distributed this survey through the virtual classroom of the subject using a Google formulary. In general, the results indicate that students are highly satisfied with Padlet, given that all the items obtained values higher than 3 (see Table 1). More specifically, item number 1 attains the highest value, with a mean value of 4,5. Following this, item number 4 has a mean value of 4,2 points. Questions number 2 and 3 also attain mean values close to 4. In addition, it is remarkable the academic performance of students, with a mean grade of 8,43 (in a 10-point scale). Unfortunately, we could not compare these results with a control group in order to analyze the extent to which Padlet contributes to the academic performance of students.

Table 1. Results of the satisfaction survey.

Questions	Mean	s.d.
1. Padlet was easy to use.	4.50	0.70
2. Using padlet helped me to better understand what I was learning in class.	3.90	1.50
3. Padlet allowed me to easily work together with my classmates.	3.90	1.28
4. I felt comfortable sharing my answers on Padlet.	4.20	0.78
5. After using Padlet, I performed higher on my daily assessments.	3.30	1.76
6. After using Padlet, I was more engaged in my learning.	3.20	1.98
7. I enjoyed using Padlet.	3.40	1.50
8. I would like to use Padlet in the future.	3.60	1.57

4. Discussion

This work introduces a teaching innovation based on online collaborative learning through Padlet. The result of this experience is a repository of material for the subject. In addition, students felt highly satisfied with the use of this tool in class and reached a good academic performance in the subject. We can summarize the main contributions of our study as follows: First, we believe that information technologies do not substitute but rather, reinforce the interactions among students and between them and the teachers. Padlet supported the collaborative work of the students both in small groups and in big group. This is a very intuitive tool, so students were ready to use Padlet from the very beginning of the subject and we did not have to invest time in initial training. Furthermore, Padlet allowed the teacher to assess continually the evolution of the students' progresses and difficulties, by reviewing real-time contributions of each student and group of students in the wall. In

addition, Padlet encourages students' reflections about their own learning and increase the flexibility of the learning process, since both students and teachers can contribute to the wall anywhere and anytime. Second and in line with MacDonald's (2003) suggestions, the effective implementation of information technologies in support of collaborative learning should be based on the students' attitudes towards cooperation. They should be aware that collaboration with their classmates will contribute to their own learning. In this sense, the use information technologies in support of collaborative learning needs the modification of the values and philosophy of the class. We believe that the joint assessment between the students and the teacher of these values were very important in this process. From the first day, the teacher emphasized the need to "build together" the subject. In fact, the material of this subject was not available for students in the virtual classroom and they built this material daily through their contributions to Padlet. Third, online collaboration contributed to increase students' competencies beyond those included in the study guide of the subject, such as team abilities, time management skills or negotiation competences and improve some affective outcomes such as team contentiousness or intrinsic motivation.

We believe that our proposal is a first step towards the use of information technologies in collaborative learning contexts. Nonetheless, our study has several limitations. On the one hand, we could not compare the benefits of Padlet in comparison to other digital platforms. In addition, our proposal is based on a sample of Master students so we could not assess the suitability of this tool in different context, for instance in groups of undergraduate students.

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Old Dogs Can Learn to Like New Tricks: One Instructor's Change in Attitude to Online Instruction from 2009-2017

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Abstract

This qualititative case study examined a veteran instructor's change in attitude about university online instruction. After a short review of the literature and explanation of the project, researchers conducted a content analysis of an instructor's annual self-reports about his online teaching of a graduate course in the social sciences. The self–reports were written between 2009 and 2017. The researchers also examined students' end-of-semester evaluation scores about the course and instructor. Results suggest that the instructor began online teaching with a mixed attitude. After four years of teaching the online course (delivered once each spring) the instructor reported more about content issues and less about online delivery. In the final the period (2016-17) the reseachers found that the instructor was invested fully in online delivery. Although the study is not generalizable, its results suggest that instructors who stay with an online system over an extended period of time may gain more confidence in the efficacy of online delivery. The findings complement previous findings in the literature about faculty attiudes toward technology use in instruction.

Keywords: Faculty Attitudes; Higher Education; Online Instruction.

1. Introduction

In less than a decade, online teaching and learning has gone from a encouraged option to a default mode of delivery at many conventional colleges and universities around the globe. While methods and systems of online teaching vary considerably—and while some subject areas and disciplines have been impacted more than others—online instruction, for good or bad, is here to stay. That is not to say that there has not been reluctance, if not resistance in moving to a digital pedagogical platform as many professors and students still prefer traditional face-to-face instruction. Nevertheless, rapid advances in digital technologies and neoliberal forces in the global economy have combined to make learing online and earning a college or advanced certificate or degree online, regardless of location, an increasingly viable and attractive choice. Meanwhile, higher education administrators, faced with ever-increasing operating costs, have found some relief in online delivery. Courses taught completely online have been found to take pressure off investment in infrastruture; they also can enroll more students per course than in traditional classrooms and be delivered at a twenty-five percent savings (Quinton, 2013). Just as revolutionary is technology's impact on the dissemination of peer-reviewed knowledge, and indeed, information, filtered and unfiltered, of all kinds. In the academic setting, faculty and students alike can now undertake a review of the literature or stay current in their respective fields' review without ever stepping into a library or opening a hardcopy journal.

This paper takes stock of how the online delivery of a graduate level course by one instructor over a nine-year period was viewed over time by that instructor. Making use of content analysis methodology, we reviewed documents produced by the instructor each year about teaching the online course. We also examined end-of-semester student evaluations of the instructor's teaching between 2009 and 2017. The results suggest that from 2009-2011 the instructor had a mixed attitude about online teaching, reporting that online delivery was less effective than face-to-face instruction. During the middle third of the timeframe (2013-2015) the instructor reported less about online delivery issues, and in the final third (2016-7) appeared to be fully invested in online delivery. Although these results are not generalizable, they suggest that instructors who stay with an online system over an extended period of time may gain more confidence in the efficacy of online delivery.

2. Review of the Literature

Psychologists have long held that attitudes—associated beliefs and behaviors towards an object—lack stability because they are vunerable to environmental influences (Davis, 1965). Classic experiments by Asch (1956) for example, demonstrated that *compliance* is a basis for attitude change. Following Asch, other researchers identified other bases for attitude change, such as *identification*, *internalization*, and *emotion* (Breckler & Wiggins, 1992).

Additionally, some attitudes and beliefs are more resilent to change than others. Political scientists Sabatier & Weible (2007), for example argued that deep core, *fundamental* beliefs (such as one's views on human nature) are highly unlikely to change. Similarly resistant (but less so than fundamental beliefs), are *policy core* beliefs (such as the proper balance between government and free market). Sabatier & Weible (2007) concluded that *secondary aspects* of a belief (such as those related to the implementation of a policy) are most likely to change. For example, as one learns about specific effects of, say, regulations versus economic incentives, one may change his attitude about government oversight. Finally, some have suggested that age may be a factor in attitude change; arguing that the older a person is, the less likely it will be that that person is able to accept or undergo a change in belief or attitude as compared to someone younger.

Applying these general concepts specifically to *attitudes toward online teaching and learning*, attitude change may be contingent on: (1) technology's environmental influences, (2) the depth of belief (along the fundamental-to-secondary-aspect coninutum) regarding what constitutes proper instruction, and (3) one's age. Fortunately, several studies have been published that test the veracity of these postulates. Khalil (2013) studied the phenomenon of faculty's emotional and behavioral resistance to technology use in higher education and found that frustration can be minimized and reluctance (or unpreparedness) can be overcome through active participation with the technology. This notion of participation is consistent with the findings of Kahn and Pred (2002) who reported that carefully designed hands-on faculty workshops—that included mastery of software, adaptating technology for specific disciplines, website design, and electronically mediated course delivery—led to faculty satisfaction with the workshops, as well as attitudinal and usage changes. Similarly, Buckenmeyer (2009) and Chen et al. (2017) found that if certain conditions exist, notably professional development and continuous access to resources, university faculty were more likely to accept and use appropriate technologies in significant instructional ways. Taken together, these studies suggest that faculty attitudes about the use of technology for teaching/learning are open to positive change if steps are taken to provide a technology-robust infastructure and continuous technical hands-on support. Although the literature on faculy attiude change *vis-à-vis* online instruction is silent on core beliefs and age, it nevertheless leaves an indirect implication that attitudes/beliefs about "proper" instruction (traditional versus online) are downstream on the fundamental to secondary aspect continum, and that age may be less of a factor than hypothesized.

3. Research Design and Details

3.1. The Online Course

This study focused on a graduate course taught seven times over a nine-year period by one instructor at a mid-sized public university in the southern United States. The course, *Critical Issues in American Education (CIAE)*, is a requirement for students pursuing a Doctor of Philosophy (Ph.D.) in Education and a Ph.D. in Higher Education. The semester-long course, divided into four units, requires students complete weekly readings, view YouTube video content (also weekly), write four papers (one for each completed unit), and write an end-of-semester review of an academic book approved by the instructor. A key feature of the course are weekly seventy-five minute online *voice chats,* when the instructor and students meet synchronously online and discuss the content assigned for each week. An excerpt from the *CIAE* syllabus of a week's schedule of assignments can be found in Figure 1.

Week 14	Globalization & Education	Chat from 5-6:15 pm
Videos:	1. Looking to 2060: A Global Vision of Long-term Growth (3:28)	
	2. Globalization linked to education (4:10)	
	3. Noam Chomsky: Discussion on Globalization? (10:58)	
	4. Interview with Gary Becker: Globalization and Inequalities (3:45)	
	5. Thomas Friedman | Globalization of Higher Education (45:44)	
	6. Joseph Stiglitz on Globalization & Its Discontents Revisited (33:05)	
	7. Naomi Klein: Disaster Capitalism (7:07)	
Readings:	Klein, Chapter 12 (pp. 373-98); Bauman, Chapter 14 (pps. 443-455).	
Writing:	Essay 4 (Globalization & Education) due 4/29 by 11:59 PM CST.	

Figure 1. Excerpt from CIAE syllabus from Week 14, 2018.

From 2009-2016 the course was delivered through the *Blackboard* Learning Management System (LMS) and in 2017 through the *Canvas* LMS. Chats were hosted through *Blackboard's* partner *Horizon Wimba* and then through *Canvas's* partner, *Big Blue Button*. In spring 2016 and spring 2017 the instructor did not teach *CIAE*.

3.2. The Instructor

This study focused on one instructor, a tenured, full professor (white, male) who specializes in the social foundations of education (philosphical, historical, political). The professor had been hired by the university in the summer of 2008. From 2008-2015 the professor also served as head of the department. At the beginning of the period of study (2009) the instructor was 49 years old and in his seventeeth year as a university professor.

3.3. Data from Annual Self-Reports

To assess if a change in the instructor's attitude occurred over the ten-year period, the researchers examined ten annual review reports submitted between 2009 and 2018. These self-reports were written by the instructor and submitted to a faculty departmental review committee annually as required by the institution. In each report the instructor reviewed in writing his performance in the categories of teaching, scholarship and professional service duing the calendar year, and set goals for the upcoming year. To assess any changes in attitude, the researchers looked specifically at the instructor's explanations of performance related to teaching and teaching goals set for each upcoming year.

In the fall of 2008 the instructor agreed to teach *CIAE* in an online format and prepared to offer the course in the spring of 2009. He taught the course every spring semster until 2016 [due a sabbatical and Fulbright semester] and resumed instruction in 2018.

4. Findings

The 2009 Annual Self-Report, written seven months after the course had ended, contained descriptive comments, some indicating hopefulness about learning online instruction, and some identifying it as an inferior means of instruction compared to traditional instruction:

> *[This] was my first opportunity … to teach an online course [in this format and at at this university), allowing me to learn about Blackboard and Horizon Wimba. …. On the official student evaluation of instruction [CIAE] students scored the course a 4.5 [out of 5.0] and [face-to-face] students scored [my other courses] 4.65. Truth be told, face-to-face teaching is superior to online teaching, but online instruction is not as bad as I once thought.*

Also in the 2009 self-report the instructor set three goals for teaching in 2010, including to:

> *Further develop my online teaching ability by increasing my understanding and abilities to use Blackboard and Horizons Wimba.*

Like the 2009 report, the 2010 report also repeated the teaching goal to improve online teaching ability. It also referenced students evaluation scores and repeated a sentence from the 2009 report:

> *On the official student evaluation of instruction, (Item 15) CIAE students scored the course a 4.62 (up from 4.50 in 2009)…Truth be told, face-to-face teaching is superior to online teaching, but online instruction is not as bad as I once thought.*

The 2011 report repeated the teaching goal to improve online teaching ability. The 2011 report once again referenced student evalution scores for their improvement on the five-point

scale. Finally, a new idea (in bold below) was replaced the phrase *but online instruction is not as bad as I once thought* and added to the original sentence stem:

> *On the official student evaluation of instruction, (Item 14) CIAE students scored the instructor a 4.71 . . . In my view, face-to-face teaching is preferable to online teaching,* **but online instruction has its advantages for students who are not near campus**.

Similar to earlier reports, the 2012 report noted changes in scores for *CIAE* on the student evaluations relative to previous semesters. The 2012 report also seemed more energized about the *CIAE* course, perhaps because that year a change in the Higher Education Ph.D. curriculum moved *CIAE* from an elective to program requirement.

> *I am changing parts of CIAE in order to broaden its relevancy for the [Higher Education] students who now take the course as a program requirement.*

The goals section of the 2012 report also reflected this new energy. Specifically, for his first teaching goal the instructor used the verb *master* rather than *increase understanding of* a newer version of the Blackboard LMS

> *Master Blackboard 9.0 and further develop materials for CIAE that are more inclusive of education at all levels.*

The 2013 report repeated the 2012 goal stated above. However, for the first time there was no mention of student evaluation scores. Instead the instructor reported on changes in the course content:

> *I changed parts of CIAE in order to broaden its relevancy for* [the new] *HE students who now take the course and the changes have been well-received.*

The 2014 and 2015 reports provided little data on the *CIAE* course, only mentioning it briefly along with another graduate level online course he had developed an taught called *Race and Education in the American South*. In 2016 and 2017 the instructor did not teach *CIAE*. During this time the university dropped *Blackboard MLS* and moved to *Canvas MLS* to deliver courses online. Starting in August of 2017, however, the instructor developed and taught three new graduate courses online, and used a similar design (Common reading, YouTube videos, weekly chats, etc..) to that of *CIAE*. In the 2017 report he wrote:

> *A good amount of time went into the two graduate courses because [k-12 Education Policy] was a new course for me to develop (and prepare for online delivery). While I have taught [History of Higher Educaiton] several times, the course was offered in an online format for the first time, and this required some time to convert to that format.*

He continued:

> *There were some kinks in the delivery of . . . courses.. . , but these problems were worked out during the semester. Student complaints about online are evident in some of the comments in the student evaluations. Nevertheless, in my view, both graduate courses (711 and 722) should continue to be offered in an online format.*

5. Analysis

5.1. Discussion

Taken as a whole, a content analysis of the instructor's annual reports between 2009 and 2017 provide evidence of a change in attitude and perpective about online instruction. At the start of his experience with online teaching the instructor had mixed feelings about the about teaching online. This conclusion is based on his use of the phrase, *face-to-face teaching is superior to online teaching*, which appeared in his 2009 and 2010 reports. In both reports, however, the instructor added to the phrase, *but online instruction is not as bad as I once thought,* an assertion that implies that he was skeptical, but nevertheless trying to keep an open mind about online instruction. By 2011 the instructor had replaced *but not so bad as I though*t with *but online instruction has its advantages for students who are not near campus,* a hint that he was looking more outward toward students and may have even seen more value in the delivery than previously. Throughout the first period (2009-2011) the instructor also set yearly goals, stating his intention to improve on his use of *Blackboard* and *Horizon Wimba*.

The instructor's words about online teaching also correlated with changes in student evaluations of *CIAE* relative to face-to face courses he taught that semester. Specifically the more that scores in the online course aligned with face-to-face courses taught that semster, the more positive the annual self–review *vis-à-vis* online teaching.

Table 1. Comparion of Student Evaluation Scores for online course (CIAE) versus Traditional Courses by Spring Semester, 2009-2013.

Annual Report Year	CIAE Score Item 14*	CIAE Score Item 15*	Score on Courses taught**
2009	4.75	4.50	4.80
2010	4.54	4.62	4.67
2011	4.71	4.71	4.61
2012	4.83	4.33	4.52
2013	4.63	4.18	4.40

Source: Univeristy Student Evalutions, 2009-2013.
* Item 14 - Overall rating of the instructor; Item 15 - Overall rating of the course.
** Mean scores of Items 14 and 15 from face-to-face courses taught in spring of that year.

During the middle third of the period under study (2012-2015) the instructor reported less about online delivery's effectiveness and more about changes he made to course content. During this period he reported less about online delivery issues, and even less about student evaluation scores.

In the final third (2016-17) the instructor appeared to be fully invested in online delivery. Even amidst *kinks in the delivery* and end-of-semester student complaints about the new platforms (Canvas, Big Blue Button), the instructor forged on and called the for the graduate course work to continue to be offered in an online format.

5.2. Conclusions

The results above support Khalil's (2013) finding that active participation can minimize faculty reluctance to new technology. The results also complement the findings of Kahn and Pred (2002) and provide further evidence that mastery of new technology also impacts faculty satisfaction and helps to soften faculty attitudes about its use in instruction. These results are also consistent with studies by Chen *et al.* (2017) and Buckenmeyer (2008) that providing readily available hands-on support factor into more acceptance and use of online technologies for instruction. While faculty may be skeptical about new technologies or new teaching methods, active participation with these technologies or formats may positively impact faculty attiutudes and perceptions.

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Using Active Learning Spaces to Support Flipped Classroom

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Abstract

Flipped Classroom, an emerging type of blended instruction, has become a popular pedagogical approach in the recent years. Active learning classroom spaces have been implemented in many university campuses to facilitate student-centered, collaborative learning environment. The purpose of this study is to examine the effectiveness of a college level flipped classroom conducted in an active learning classroom space as compared to its traditional face-to-face counterpart. Two sections of a business course taught by the same instructor during one semester were selected for the study. The two sections had the exact same coverage and evaluation policy while one is a flipped class conducted in an active learning classroom space and the other is a traditional face-to-face class. We conducted both quantitative and qualitative analyses and our results reveal that there is no statistically significant difference of students' performance between the two classes. However, students reported a more positive learning experience in the flipped classroom setting.

Keywords: Active Learnig Spaces; Flipped Classroom; Active Learing; Student Engagement; Distance Education.

1. Introduction

Distance education is one of the fastest growing trends in educational uses of technology. It continues to grow and the growth rate shows no sign of slowing down in the near future. According to the most recent Distance Education Enrollment Report, from Fall 2015 to Fall 2016, 31.6% of all students in higher education are taking at least one distance education course (Seaman et al., 2018). There are more than 6 million students in the U.S. that are now enrolled in higher education distance education courses.

The quality of distance education has always been a concern. The Department of Education conducted a meta-analysis to review online learning studies (Means et al., 2010). The results showed that instruction combining online and face-to-face elements had a larger advantage relative to purely face-to-face instruction. The mean effect size in studies comparing blended with face-to-face instruction was +0.35 ($p<.001$). Blended instruction has become increasingly popular in higher education settings, offering students both the benefits of face-to-face instruction and the flexibility of online learning.

1.1. Flipped Classroom

Flipped Classroom, an emerging type of blended instruction, has become a popular class structure in the recent years. The term refers to a pedagogical model in which the lecture and homework elements of a course are reversed. Typically, the instructor provides prerecorded lectures for students to view at home before the class session. The videos might contain self-check quizzes which provide immediate feedback of the student's understanding of the course material. The students then bring their questions to the class and participate in the in-class discussions and activities led by the instructor.

A Flipped Classroom model gives students control of the prerecorded lectures so they can watch, rewind, and repeat as needed. It also allows instructors to devote more class time to application of the lectured content, hands-on activities, discussion and interaction. Additionally, this model allows institutions to strategically move some of the contact hours or seat-time that normally occurs in the classroom to an online setting, and ultimately frees up classroom space.

It has been documented that given enough blended courses, an institution can significantly increase capacity to serve additional students (Shea, 2007). This increased physical capacity makes higher education more accessible without additional investment in physical infrastructure. Furthermore, it reduces students' need to be on campus at a particular time. By putting the course lectures online, students can access the material anytime anywhere, which provides them with great flexibility. This is especially helpful for students with long commutes as they don't have to spend time commuting and parking. It can add up to a significant time savings. Therefore, many students prefer blended courses over the face-to-

face ones due to the reduction in time and space commitment (Strambi & Bouvet, 2003; Wingard, 2004; McCray, 2000).

Studies on flipped classrooms have yielded mixed results. Some previous studies found that the flipped classroom has a positive impact on student learning and educational experience. For example, Baepler et al. (2014) found that students' learning outcome is significantly better in a flipped classroom than that in a regular face-to-face classroom. However, other researchers argue that no evidence is found that flipped learning has improved students' grades and indicated that there was no significant difference in student performance between flipped classrooms and traditional classrooms (Kim et al., 2014; Davies et al., 2013; Strayer, 2012). Despite the mixed empirical results, indirect evidence such as student self-reported data shows that students preferred the flipped method compared with traditional pedagogical strategies (Roach, 2014; Gilboy et al., 2016).

1.2. Student Engagement and Active Learning

Student engagement is a key to the success of flipped classrooms, especially during the in-class time. Learning can be deepened, enhanced, and become meaningful if students are actively engaged through interactivity, multiple roles and social engagement such as group work and discussions. Researchers found that learning increases as the amount of student engagement increases (Grissom et al., 2003; Carini et al., 2006). National Center for Education Statistics (2016) further reported that student engagement can also positively impact learners' persistence and lead to learners being more likely to complete their undergraduate degree.

Active learning, a pedagogical model, has been shown to be effective in strengthening student engagement and making students responsible for their own learning (Gatch, 2010). Active learning was first defined by Bonwell and Eison (1991) as "anything that involves students in *doing things and thinking about the things they are doing*". This pedagogical approach actively engages students in the learning process and helps students move from remembering and understanding to analyzing and creating in Bloom's Taxonomy level of learning. It refers to a broad range of teaching strategies that engage students. In a face-to-face classroom setting, these strategies often involve activities with some amount of collaborative group work that facilitate knowledge exchange, construction, and transfer. Thus, the instructor is able to spend significantly more time with the students who are engaged in active learning compared to the student-as-passive vessel context (Gannod et al., 2008; Felder & Brent, 2009).

1.3. Active Learning Space

While faculty are adopting active learning teaching strategies and working towards maximizing student engagement, traditional classroom spaces designed for students as

passive knowledge receivers from a lecturing professor at the front of the classroom present many challenges. These spaces cannot be easily configured to support collaborative group work as well as instructor mobility and participation in students' learning. Researchers and practitioners have called for the design of new active learning environment to support collaborative and project based learning (Jamieson, 2003; Harris, 2010; Harvey & Kenyon, 2013). These new active learning spaces often include modular and flexible furniture that can be easily rearranged to accommodate teaching and learning. New technologies have also been integrated to support collaborative learning activities. Researchers have reported that active learning spaces have positive impact on student engagement and student expectations (Webb et al., 2008).

2. Background

This study is held at a regional comprehensive state university, which is located on the east coast of the United States near a major metropolitan area. Currently, there are about 17,500 students enrolled in the university, including both undergraduates and graduates. The university has been encouraging faculty to adopt flipped classroom strategies to utilize class time more efficiently and promote active learning. During the last three years, the university has constructed fifteen new active learning classrooms in three major academic buildings. By integrating the flipped classroom pedagogy with active learning spaces, the researchers hope to provide a flexible, collaborative, and effective way to support students' learning.

A general business education course was selected for this study. The demand for this course has been trending upwards within the last few years. The department offers around 15 sections on average every semester. Students are from different majors with different learning styles and pathways.

Our research questions is: Integrating with active learning space, does flipped classroom yield effective student learning outcomes and student engagement as compared to face-to-face classroom?

3. Methodology

Two sections of the business course that taught by the same instructor during one semester were selected for our study. The two sections had the exact same coverage and evaluation policy while one was a flipped class and the other was a face-to-face class. Additionally, the flipped class was held in a newly renovated active learning classroom. Students were evaluated based on class participation, homework and exams. We examine students' performance from the two sections. To determine whether there is a significant difference

between the two sections, we use the t-test. The p-value is reported in the result table. We also designed a survey to assess students' perception of the learning environment and outcome. Six-point Likert scale was used to measure the responses, with 6 being "strongly agree" and 1 being "strongly disagree". The survey was administered at the end of the semester before the final exam.

4. Results and Discussion

The sample included 36 students in the face-to-face class and 37 students in the flipped class. Both of the two sections were consist of business major and non-business major students. Table 1 presents the composition of the two classes.

Table 1. Class composition of the two sections

	Face-to-face Class	Flipped Class
Business Major	26	30
No-Business Major	10	7

As shown in Table 1, the majority of the students were business majors in both classes. Business majors include accounting, economics, finance, management and marketing. Non-business majors are students from colleges other than the business school. There were 26 business major students and 10 non-business major students in the face-to-face class, while 30 business major students and 7 non-business major students in the flipped class. In general, there is no significant difference regarding student composition between the two classes.

In the face-to-face class, students were required to present in every class and the instructor provided in-class lectures. In the flipped class, students were required to watch lecture videos that instructor prepared in advance and then brought questions to the class. The instructor used the class time to answer questions and clarify students' confusion. In addition, the instructor designed exercise problems and hands-on activities utilizing active learning spaces to deepen students' understanding of the course materials.

4.1 Quantitative Results and Discussion

Table 2 shows the average score of the three in-class exams and the final grade for the course between the face-to-face and flipped class. T-statistics is used to test if there is significant difference of student performance between the two classes.

Table 2. Student's performance between the face-to-face and flipped class

	Exam #1		Exam #2		Exam #3		Final Grade	
	Face-to-face	Flipped	Face-to-face	Flipped	Face-to-face	Flipped	Face-to-face	Flipped
Observation	36	37	35	36	35	36	36	37
Mean	84.6	83.2	82.1	77.3	73.3	74.1	81.2	81.1
T-statistics	0.598		1.488		-0.332		0.039	
P-value	0.552		0.141		0.741		0.969	

The mean score of the Exam #1 is slightly higher in the face-to-face class. Exam #1 only covered introductory concepts and principles for the course. The materials were relatively easy to understand. Students performance were very comparable between the two classes. The contents tested in the Exam #2 were related to comprehensive understanding of economic indicators and models. It required the mathematical and graphical skills. The mean score of the Exam #2 in the face-to-face class was 82, which is about 5 points higher than the mean score in the flipped class. Exam #3 was built on the knowledge learned from the previous two exams and developed further to analyze policy implications. The mean score in the flipped class becomes a little higher in the Exam #3. When combining other evaluation components, the mean score of the final grade is almost same between the two classes. Using the t-test, there is no evidence of statistically significant difference between the two classes for all the exam scores and final grade. This result is consistent with other flipped classroom research findings that flipped and traditional classrooms yielded no significant difference on student performance (Kim et al., 2014; Davies et al., 2013).

Additionally, we do see a learning curve for students to adapt the flipped classroom format. When the course material involved equations and graphs which were not taught by the traditional face-to-face format, students might need extra time to adjust the learning process. It explained why the mean score of the Exam #2 was lower for the flipped class than that of the face-to-face class. After the learning curve, students were able to take advantage of the flipped class more effectively which was evidenced by the higher mean score in the Exam #3 comparing with the face-to-face class.

A brief survey was developed to assess students' learning experience. The response rate was 89%. Table 3 reports the mean score of the responses to each question. A score of 6 indicates "strongly agree" and a score of 1 indicates "strongly disagree".

Table 3. Survey results

		Face-to-face	Flipped
1	The overall quality of teaching.	5.0	5.1
2	The classroom interactions (instructor to student, student to student) are positive.	5.7	5.8
3	The classroom environment was comfortable and promoted learning.	5.3	5.6
4	The instructor maintained a positive classroom atmosphere.	5.6	5.8
5	The class activities are organized in a way that helped student learn the material.	5.1	5.2
6	The instructor explained concepts using real-world examples, analogies, or circumstances relevant to student's life.	5.5	5.7

The survey results show that students in the flipped class rated every question higher than the students in the face-to-face class. In general, they agreed flipped class provided more positive learning experience. The active learning space also facilitated the learning process with a comfortable and engaging environment.

4.2. Qualitative Results and Discussion

The final question of the survey elicited participant comments. The following themes were identified among student comments: Class Video, Class Organization and Activities, and Learning Environment. We will describe each theme with examples of relevant comments provided.

Class video is the most frequently referenced theme. The videos referred here are the prerecorded lecture videos for students to watch at home. Students watch these videos in the learning management system during the "online" portion of the course. All comments about class videos are positive. One student commented: "I enjoyed being able to watch class videos because it allowed me to learn the content at my own pace." Some sang high praises of video lectures: "I excelled and enjoyed watching the online lecture….", "…having the lectures online is extremely helpful".

Class organization and activities are overlapping themes that often mentioned together. This is because the way class activities run has a huge impact on class organization, especially in a flipped classroom. Multiple students commented that being able to watch the

videos online and participate in more meaningful activities in class helped them learn better: "…class time is used to review and do activities that make sure we understand", "I really liked the hybrid format of the course…come to class to reinforce that material through activities."

The Learning environment theme refers to the active learning classroom space. This space encompasses a group of elements such as flexible furniture, multi-screen projection system, collaborative work space, etc. Two students offered specific, positive comments toward the class space. One student commented: "…very friendly, created a comfortable learning environment". The other student felt the same way: "… I also really liked how structured it (the classroom) was…which helps me learn better."

5. Conclusion

The flipped classroom model offers a new approach to instruction that allows teachers to foster active and collaborative learning as well as provide flexibility to anytime and anywhere learning. Findings from this study suggest that flipped classroom utilizing active learning spaces is as effective as traditional face-to-face instruction. Furthermore, students have a more positive learning experience in the flipped classroom setting for both online and face-to-face components. The use of active learning spaces also contributes positively to building a comfortable and engaging learning environment.

No study is without its limitations and ours is no exception. The sample size was relatively small and there was only one instructor involved in the study. There is also the novelty effect of the new classroom, which may diminish overtime. Continuing research is needed to involve larger sample sizes, more instructors, as well as more in-depth and specific student feedback and collect longitudinal data.

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Characterizing university students' self-regulated learning behavior using dispositional learning analytics

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Abstract

Learning analytics can be used in conjunction with learner dispositions to identify at-risk students and provide personalized guidance on how to improve. Participants in the current study were students (n=192) studying a first year anatomy and physiology course. A two-step cluster analysis was performed using learning analytics data from the learning management system and self-regulated learning behavior from meta-learning assessment tasks. Three clusters of students were identified – high, medium and low self-regulated learners. High self-regulated learners were engaged with the meta-learning tasks, reported the most self-regulated learning strategies and used new strategies during semester. They also had the highest academic achievement. Compared to low self-regulated leaners, medium self-regulated learners were more engaged in the meta-learning tasks and used more learning strategies during semester, including new strategies; however, both medium and low self-regulated learners had similar levels of academic achievement. It is possible that the medium self-regulated learners represent students who were attempting to improve their learning, but had not yet found strategies that were right for them. Future evaluation of academic performance may determine whether the attempts to improve learning by medium self-regulated learners distinguishes them from low self-regulated learners in the later years of their study.

Keywords: Self-regulated learning; learning analytics; academic achievement; cluster analysis.

1. Introduction

Every time a student interacts with a website - such as logging onto a student portal or submitting assignments - a digital trail is left behind. Learning analytics involves the collection, measurement and analysis of this trace data to improve learning and teaching (Tempelaar et al., 2018). Previous studies using learning analytics have identified online factors that correlated with course outcomes, such as log-in frequency, and engagement with the learning management system (LMS), such as submitting assessment, viewing assessment feedback and contributing to discussion boards (Colthorpe et al., 2015; Macfadyen & Dawson, 2010; Smith et al., 2012). These findings demonstrate the potential for learning analytics to identify indicators of online engagement that may influence student progress within a course and their academic performance. Such information can potentially allow course coordinators to intervene by identifying at-risk students early.

Learning analytics may help to identify disengaged students who are academically at-risk; however, it does not explain why these students are at-risk, nor how they can improve. More recently, learning analytics data has been combined with learner dispositions to better understand how students engage with learning activities, so that more targeted feedback can be provided to at-risk students (Shum & Crick, 2012; Tempelaar et al., 2017). The combined analysis of learning data and learner data has been termed 'dispositional learning analytics' (Tempelaar et al., 2017). Dispositional learning analytics researchers have augmented traditional trace data with a variety of student dispositions, including students' expectancies and values, motivations, approaches to learning, emotions, goals or lifelong learning traits (Gašević et al., 2017; Shum & Crick, 2012; Tempelaar et al., 2018; Tempelaar et al., 2017). These studies have demonstrated that collecting self-reported data on learner dispositions increased the predictive power of learning analytics models (Tempelaar et al., 2017).

Although a broad range of dispositions have been incorporated into learning analytics studies, the specific types of self-regulated learning strategies students use while they learn have been largely ignored. Past research has demonstrated that students can use a variety of different learning strategies (Colthorpe et al., 2017; Hattie & Donoghue, 2016). Certain types of strategies are more effective than others. For example, strategies where students organize or transform information are associated with high academic achievement (Nota et al., 2004), whereas more passive learning approaches, such as managing the environment, are less effective (Hattie & Donoghue, 2016). In addition, higher achieving students use more learning strategies than lower achieving students (Kitsantas, 2002). The current study expands the field of dispositional learning analytics by combining learning analytics data with students' goal orientation, the type and number of learning strategies used during exam preparation, and their strategy adaptability. This data was used to group students using two-step cluster analysis.

2. Methods

Participants were students studying a first-year anatomy and physiology course at the University of Queensland, Australia. As part of course assessment, students completed four online meta-learning tasks (12%) consisting of open-ended questions designed to encourage students to reflect on their learning (Colthorpe et al., 2018). Learning analytics data was collected from the tasks, including average word count per question, submission time and task completion rate. Other course assessment included a mid-semester exam (20%), end of semester exam (50%) and group assignment (18%).

This study received ethics approval from the University of Queensland Human Ethics Committee. To ensure consenting students (n=192; 74%) were academically representative of the whole cohort, a t-test was used to compare their final exam results. There was no significant difference (p>0.05) between consenting participants (65.8% ± 1.1) and the whole cohort (64.9% ± 1).

2.1. Self-regulated learning behaviors

Responses to meta-learning questions were thematically analyzed to characterize students' self-regulated learning behaviors. Early in semester, students described their personal goals for the course. Responses to this question were deductively coded (Braun & Clarke, 2006) into mastery or performance goals (Hattie & Donoghue, 2016). Half-way through semester, students described the study strategies they used when preparing for the mid-semester exam. Responses to this question were deductively coded using the learning strategy categories identified in the self-regulated learning interview schedule (Nota et al., 2004) to determine both the type and number of strategies students used. In a meta-learning question asked at the end of semester, students identified new strategies they had used during the course. This question was coded to determine how many new strategies students used, which indicated their adaptability.

To confirm the reliability of the coding schemes, a second naïve researcher coded 25% of the data for both goals and strategies, with inter-rater reliability scores of 87% and 89% respectively. These reliability scores are acceptable for coding self-regulated learning strategies (Nota et al., 2004).

2.2. Cluster analysis

A two-step cluster analysis was performed in SPSS^{TM} (IBM Statistics, NY, USA) using the learning analytics data (meta-learning task completion rate and time of submission, and the average number of words written for each question) and self-regulated learning behavior (type and number of learning strategies used, goals, and strategy adaptability). The two-step clustering procedure (Tkaczynski, 2017) involves the formation of pre-clusters, where

students within the same pre-cluster are treated as a single entity. In the second stage of the procedure, the pre-clusters are merged using a hierarchical clustering algorithm. The procedure generated a 3-cluster model when using either the Schwarz's Bayesian Criterion and Akaike's Information Criterion to determine optimal cluster number. The variables with the most influence over cluster formation included the type of goals students set, the number of planning strategies and the total number of learning strategies students reported using for the mid-semester exam (Figure 1).

The clustering procedure was validated by splitting the sample into two random groups and then repeating the procedure to ensure that the same number of clusters with similar characteristics were generated compared to the original cluster solution.
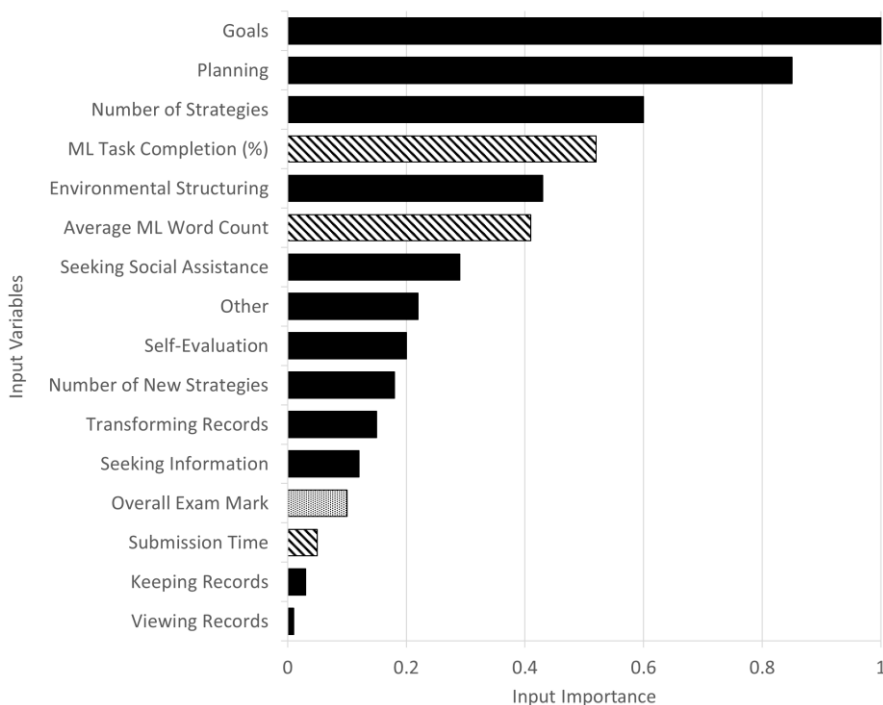
Figure 1. Predictor importance of variables in generating clusters. Solid bars represent self-regulated learning strategies. Bars with diagonal lines represent meta-learning (ML) task analytics. The dotted bar represents the students' exam mark.

3. Results

The two-step cluster analysis separated students into high, medium and low self-regulated learners (Table 1). High self-regulated learners (n=43) reported using the most learning strategies for exam preparation, and the most new strategies. They had the highest academic

performance (71.4% ± 2.3), wrote the most detailed responses for the meta-learning tasks, and had a high task completion rate. Low self-regulated learners (n=55) reported the lowest number of learning strategies, were the least likely to try new strategies and relied on mastery goals. These students were also the least engaged with the meta-learning tasks with the lowest word count for their responses, and the lowest completion rate. Medium self-regulated learners (n=72) set a combination of mastery and performance goals, used more strategies than low self-regulated learners and were willing to try new strategies. They had higher engagement with meta-learning tasks than low self-regulated learners, but had similar exam results (medium = 64.6% ± 1.7; low = 64.4% ± 2). High and medium self-regulated learners relied most heavily on self-evaluation and transforming records strategies, whereas low self-regulated learners relied on reviewing records (Figure 2).

Table 1: Characteristics of students clustered into high, medium, and low self-regulated learners. SEM = standard error of the mean, ML = Meta-learning task, M = mastery goals, P = performance goals, n.s. = non-significant.

	Low (1)	Medium (2)	High (3)	Significance
Overall exam mark (mean ± SEM)	64.4 ± 2	64.6 ± 1.7	71.4 ± 2.3	3>1,2*
ML word count (mean ± SEM)	62.9 ± 3.4	81.7 ± 3.6	95.8 ± 4.9	3>1, 2; 2>1*
ML submission time (mean hrs ± SEM)	60.1 ± 7	73.1 ± 5.9	79.5 ± 8.8	n.s.
Students completing all ML tasks	65%	100%	98%	2,3>1+
Goal type	75% M only	1% M only	60% M only	M only = 1,3>2;
	11% P only	29% P only	12% P only	M+P = 2>1,3+
	14% M+P	70% M+P	28% M+P	
Strategies for exam (mean # ± SEM)	2.1 ± 0.1	2.9 ± 0.1	3.8 ± 0.2	3 >1,2; 2>1*
New strategies (mean # ± SEM)	1.1 ± 0.1	1.6 ± 0.1	1.5 ± 0.1	2,3>1*

Statistical signifcance between low (1) medium (2) and high (3) self-regulated learners was determined using *ANOVA with Tukey's post hoc test or + chi-square test.

4. Discussion

In this study, a two-step cluster analysis was used to categories students based on their engagement with online meta-learning tasks, their self-regulated learning behavior and academic achievement. Three groups of students were identified – low, medium and high

self-regulated learners. The LMS data used to measure engagement with the meta-learning tasks included average word count for each meta-learning question, submission time for the meta-learning tasks and completion rate of the tasks. Word count and completion rate varied between clusters; however, submission time did not. Only 65% of low self-regulated learners completed all meta-learning tasks, whereas almost all medium and high self-regulated learners had a 100% completion rate. In addition, high self-regulated learners wrote more words on average for each question than medium self-regulated learners, who in turn wrote more than low self-regulated learners. As medium and low self-regulated learners had similar exam scores, these results suggest that engagement with the online meta-learning tasks does not relate to academic performance. In contrast, other studies have shown a correlation between LMS data, such as task submission time (Colthorpe et al., 2015) and assignment completion rate (Macfadyen & Dawson, 2010), with academic performance. As the meta-learning tasks in the current study were designed to prompt students to think about their learning, the high and medium self-regulated learners may have been more interested in the tasks, and completed them more thoroughly compared to low self-regulated learners. Future studies could include additional LMS data, such as completion of formative assessment (Tempelaar et al., 2018) or discussion board use (Macfadyen & Dawson, 2010) to facilitate the identification of non-engaged and low performing students.
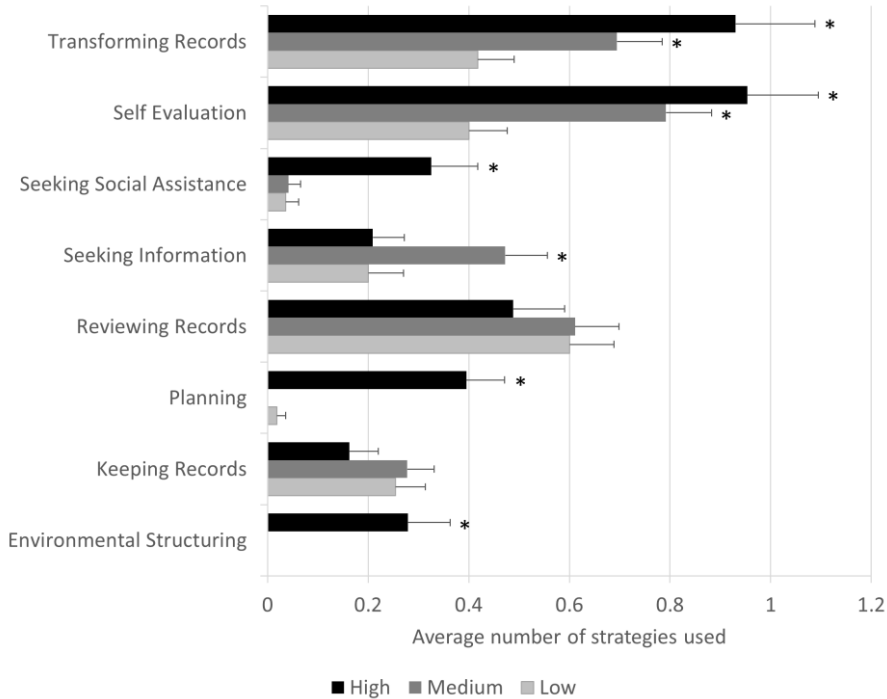
Figure 2: Self-regulated learning strategies used by students clustered as high (black bars), medium (dark grey bars) or low (light grey bars) self-regulated learners. Data represents the average number of strategies used by students in each cluster ± SEM. Asterisk indicates significant difference from low self-regulated learners using Welch's ANOVA with Games-Howell post hoc test.

Although low and medium self-regulated learners had similar academic achievement, they differed in their self-regulated learning strategies. High and medium self-regulated learners used more strategies than low self-regulated learners, a trait that has been associated with higher academic performance (Kitsantas, 2002). In particular, high and medium self-regulated learners used more strategies involving transforming records (E.g. Summaries, diagrams and flow charts) and self-evaluation (E.g. Practice tests and group study) compared to low self-regulated learners. These strategy categories have been identified as deep strategies, which are effective for learning (Hattie & Donoghue, 2016; Nota et al., 2004). Both high and medium self-regulated learners were also more likely to seek help either from social sources (seeking social assistance) or non-social sources (seeking information) respectively. High self-regulated learners were more likely to use planning and environmental restructuring than medium or low self-regulated learners. Although planning has been associated with high academic achievement (Hattie & Donoghue, 2016; Kitsantas, 2002), managing the environment is less effective (Hattie & Donoghue, 2016).

If the medium self-regulated learners used more strategies overall, and more deep strategies than low self-regulated learners, why was there no difference in their academic achievement? Perhaps the medium self-regulated learners were actively attempting to improve their learning approach, but had not yet achieved an improvement in grades. In support of this hypothesis, medium self-regulated learners incorporated more new strategies during semester compared to low self-regulated learners, suggesting that they were experimenting with their learning approach. The students in the current study were in their first year at university, and may need time to identify learning strategies that work well for them. In a study by Colthorpe et al. (2018), second year students who adapted learning strategies during semester had lower overall academic performance compared to students who did not adapt, but also demonstrated an improvement in grades over time. Together, these results suggest that incorporating new strategies can improve academic performance, but it might take multiple semesters for students to find approaches that work best for them. In the current study, medium self-regulated learners also set both mastery and performance goals, suggesting that they were attempting to improve both their understanding of the course content, and their course grades.

Learning analytics can be a powerful tool for monitoring student success and identifying students in need of support (Macfadyen & Dawson, 2010). In the current study, dispositional learning analytics was used to characterize students based on self-regulated learning behavior; however, the procedure was less successful at identifying students at different levels of academic achievement. Potentially, the medium and low self-regulated learners identified in this study reflect differences between clusters of students who are aware of their learning processes and are actively attempting to improve and students who are not (Ainscough et al. 2018). Examining the performance of these students at later stages of their program may provide evidence of the effectiveness of their approaches.

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Place Matters! Fostering place-based geoscience teaching at the University of Hawai'i at Mānoa

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Abstract

Drawing on the importance of place has been shown to be a powerful tool in education. This paper explores place-based teaching (PBT) in geoscience courses at the University of Hawai'i at Mānoa's School of Ocean and Earth Science and Technology, where faculty and student demographics sharply differ. Despite these differences, survey results from geoscience faculty (n=59) and students (n=83) revealed a strong consensus: 78% of students and 83% of faculty reported that PBT is an important and effective practice to reach all students. Most faculty (91%) indicated that they currently incorporate at least some PBT practices in their geoscience classes and would like to incorporate additional ones in the future. However, many faculty expressed concern about lack of knowledge or resources, particularly regarding PBT strategies that require a high level of cultural competency. We therefore propose a three-layered PBT framework, where faculty can start with more accessible PBT strategies (the base layer) and progress upwards as their cultural competency deepens. Through providing geoscience resources and professional development opportunities, we can empower faculty to include more diverse and culturally meaningful practices as their experience and knowledge deepens.

Keywords: Place-Based Teaching; Culture; Indigenous; Geoscience; Ocean, Earth, and Environmental Science; Hawai'i.

1. Introduction

Place-Based Teaching (PBT) can be defined as using place, people, and its resources (*e.g.*, linguistic, cultural, or environmental) as foundation for learning.   Widely considered as powerful pedagogical approach across disciplines and grade levels (*e.g.,* Elder 1998, Sobel 2004), PBT yields many positive student outcomes, such as increasing interest and motivation (Smith and Sobel 2010); strengthening place attachment (Semken and Butler Freeman 2008); promoting strong relationships with local communities (Sobel 2004); and cultivating environmentally conscientious citizens (Stapp et al. 1969).   Whereas PBT can be a successful approach for engaging all students, it has been shown to be exceptionally effective with indigenous students (*e.g.*, Cajete 1994, Semken et al. 2017).   In studies specific to *geoscience* (defined here as ocean, earth and environmental science), bridging traditional indigenous knowledge with Western science and community needs has been shown to increase students' interest by promoting learning rooted in indigenous history, community, culture and language while preserving students' cultural identity (*e.g.*, Reano and Ridgway 2015, Smythe et al. 2017).   In Hawaiʻi, geoscience professors have found a variety of ways to integrate indigenous and Western knowledge, such as having *kupuna* (elders) co-lead fieldtrips (Gibson and Puniwai 2006), accessing historical weather data from Hawaiian newspapers (Businger et al. 2017), and developing curriculum focused on people & relationships and place & culture (Lemus et al. 2014).   The University of Hawaiʻi (UH) at Mānoa has a highly diverse enrollment, including 16% Native Hawaiians and Pacific Islanders (NHPI).   However, these indigenous students comprise only 7% of School of Ocean and Earth Science and Technology (SOEST) students (IRAO, 2019).   This underrepresentation in geoscience majors is surprising given that NHPI thrived as ethnogeoscientists for centuries (*e.g.,* Lincoln & Vitousek 2017), and raises several questions: Does PBT appeal to current SOEST students and faculty?   Might PBT attract more indigenous students to SOEST?   How can we support faculty who want to incorporate more PBT into their classrooms?   These are some of the questions we tackle in this study.

2. Methods

In Spring 2018, we created two online surveys with a mix of multiple-choice, Likert scale and open-ended questions to acquire information and perceptions from faculty and students about PBT in SOEST classes (Table 1).   Our approach focuses on student and faculty perceptions and differs from studies which evaluate perceived benefits of PBT (*e.g.*, Semken and Butler Freeman 2008).   The protocol was approved as exempt by the UH Institutional Review Board (#2018-00399).   During Fall 2018, we emailed SOEST teaching faculty (n=120) and students (n=276) with a request to complete the respective surveys. Surveys were open for three weeks, during which two reminders were sent.   49% of faculty

(n=59) and 29% students (n=81) responded. Data were analyzed with the SurveyMonkey data analysis software.

Table 1. Faculty and Student Survey Questions

A) Faculty Survey Questions (13 total)

1. Place-Based Teaching (PBT) is a pedagogical approach that can be defined as using place and its resources (*e.g*., linguistic, cultural, historical, spiritual, environmental, or physical) as a foundation for learning across disciplines. Is there anything that you would like to add or change to this definition of PBT? (OE)
2. PBT in Hawaiʻi is an important and effective strategy to reach: (MC)
3. Which instructors should use PBT when teaching in SOEST? (MC)
4. Which PBT approaches do you currently use in your teaching, if we define "place" as Mānoa, Oʻahu, Hawaiʻi or the Pacific region? (MC-all)
5. Which PBT strategies do you <u>not</u> currently use in your teaching but would like to in the future? (MC-all)
6. On a scale of 1 to 5, with 5 being very comfortable and 1 being very uncomfortable, how would you rate your level of comfort in incorporating the following PBT strategies into your teaching: (L5)
7. Have you participated in any professional development training with regard to PBT practices and strategies?
8. What SOEST lab and lecture classes have you taught in the past 3 years? (MC-all)
9. What level are these SOEST lab and lecture classes? (MC- all)
10. Where are you from (born and/or raised)? (MC)
11. What best describes your gender? (MC)
12. What is your ethnic origin? (MC- all)
13. Is there anything else that you would like to add about place-based teaching? (OE)

B) Student Survey Questions (14 total)

1. What is your current status in SOEST? (MC)
2.-3. Same as Faculty Question 2-3

4. What % of your SOEST lab and lecture classes have incorporated strong ties to place in the curriculum, if we define "place" as Mānoa, Oʻahu, Hawaiʻi or the Pacific region? (MC)
5. In what SOEST disciplines were these place-based lab and lecture classes? (MC-all)
6. What level were these SOEST lab and lecture classes? (MC-all)
7. What aspects of PBT were included in these SOEST place-based lab and lecture classes? (MC- all)
8. Please select the answer that best indicates your agreement or disagreement with the following statement: *"SOEST lab and lecture classes with strong ties to place (Mānoa, Oʻahu, Hawaiʻi or the Pacific region) have greatly improved my learning experience"* (L5)
9. Please select the answer that best indicates your agreement or disagreement with the following statement: *"SOEST lab and lecture classes and courses with strong ties to place (Mānoa, Oʻahu, Hawaiʻi or the Pacific region) have significantly increased my interest in pursuing a major and/or career in the Earth, Ocean, and Environmental Sciences"* (L5)
10. What aspects of PBT would you like to see included in your SOEST lab and lecture classes in future semesters? (MC- all)
11.-14. Same as Faculty Questions 10-13

Codes: (OE) = open-ended; (L5) = 5-point Likert-scale; (MC) = Multiple Choice – single response required; (MC-all) = Multiple Choice – check all that apply.

3. Survey Results

The 81 student respondents included undergraduate (43%) and graduate students (53%). About one-third (35%) were from Hawaii or the Pacific, 41% from the US mainland, and 24% from other countries. Most (54%) of the 59 faculty respondents were from the US mainland, with 34% from abroad and only 13% from Hawaii or the Pacific. Faculty were predominantly Caucasian (79%), with 18% Asian, 2% NHPI and 6% reporting at least one other ethnicity. Students were 61% Caucasian, 38% Asian, 9% NHPI, and 21% reporting at least one other ethnicity. (Totals exceed 100%, as respondents can select multiple ethnicities.). Faculty were mostly male (57%), whereas students were mostly female (66%). In summary, student respondents were more likely to be "local" (from the Hawaii-Pacific region), ethnically diverse and female. Faculty were more likely to be non-local (from the US or abroad), Caucasian and male. Students overwhelmingly reported that courses with strong ties to place "greatly improved my learning experience" (81% agreed /strongly agreed vs. 3% disagreed/strongly disagreed) and "significantly increased my interest in pursuing a major and/or career" in the geosciences (75% agreed/ strongly agreed vs. 1% disagreed /strongly disagreed). All (100%) students reported they would like to see more PBT in SOEST courses. When asked "what aspects of PBT would you like to see included in your SOEST lab and lecture classes in future semesters?" all PBT strategies were popular; most voted for more field trips (81%) and least desired are community workdays (46%; Table 2). Survey results indicated strong support among both students and faculty for PBT: 78% of student and 83% of faculty respondents reported that PBT is an important and effective practice to reach <u>all</u> students. With the majority of SOEST faculty being non-local, we were interested in finding out from both groups which instructors they believe should use PBT. The vast majority of faculty (69%) and students (78%) responded that <u>all</u> instructors should teach in the context of place: very few faculty (3%) and students (13%) indicated that only local and/or indigenous instructors should use PBT. Several faculty and students noted that which instructors should use PBT depends on their expertise and subject matter – not their ethnic background or birthplace. The vast majority of faculty (91%) reported using some PBT practices in their SOEST classes. There is broad general agreement between faculty and student responses on what types of PBT are currently being used, with local/regional data sets being the most common (Table 2). Relatively few faculty reported incorporating indigenous knowledge or ways of knowing (33%), cultural practices (24%), service learning (19%), or community workdays (10%) into their classes. Interestingly, approximately half of students (44%) and faculty (47%) reported that Hawaiian language terms were used, although the extent or efficacy is unclear.

Table 2. Summary of survey responses regarding place-based teaching (PBT) in SOEST, and faculty comfort level in using these practices.

Answer Choices (check all that apply)	Student Survey Responses		Faculty Survey Responses		
	Q7 What aspects of PBT were included in these SOEST place-based lab and lecture classes?[1]	**Q10** What aspects of PBT would you like to see included in your SOEST lab and lecture classes in future semesters?[1]	**Q4** Which PBT approaches do you currently use in your teaching, if we define "place" as Mānoa, Oʻahu, Hawaiʻi or the Pacific region?[1]	**Q6** How would you rate your level of comfort in incorporating the following PBT strategies into your teaching?[2]	**Q5** Which PBT strategies do you not currently use in your teaching but would like to in the future?[1]
Local/regional data sets	91%	70%	79%	4.6	9%
Local/regional experts as guest speakers	43%	69%	59%	4.5	16%
Field trips	76%	82%	53%	4.3	17%
Service learning	19%	51%	19%	3.5	29%
Community workdays	19%	46%	10%	3.3	26%
Hawaiian language terms	44%	64%	47%	3.2	22%
Cultural practices	25%	59%	24%	2.8	26%
Indigenous knowledge, or ways of knowing	43%	69%	33%	2.9	29%
None of the above	0%	0%	9%	--	28%
Other	4%	9%	21%	--	14%

1Percentage of respondents who selected this choice. 2 Likert scale, ranging from 1 (very uncomfortable) to 5 (very comfortable).

Faculty were asked to report their comfort level with each PBT practice on a Likert scale of 1 (very uncomfortable) to 5 (very comfortable), and these comfort levels broadly tracked with the types of strategies used. For example, the three most commonly used practices were local/regional data sets (79%), local/regional experts as guest speakers (59%) and field trips (53%), and these strategies corresponded to the three highest comfort scores (4.6, 4.5, and 4.3, respectively) (Table 2). Similarly, the PBT strategies that faculty don't currently use but would like to use in the future (*e.g.,* indigenous knowledge, cultural practices, community workdays and service learning) broadly correlated with lower comfort ratings (*e.g*., 2.8-3.5). In addition, the survey revealed that very few faculty (12%) have received professional development (PD) training on PBT. This indicates that PD training aimed at increasing faculty comfort levels with specific PBT strategies would likely result in increased implementation of those strategies.

4. Discussion & Next Steps

Teaching through a lens of place and culture can be richly rewarding; it can also be daunting, particularly for non-local faculty. In open-ended comments, faculty wrote: *"It's hard to incorporate Hawaiian culture and indigenous knowledge into SOEST courses if you're not from here. First, I don't know enough to teach on these topics. But even if I did, I would be concerned about how students would react to being taught about these things from a haole* [Caucasian, or non-local person]. *That said, I think it would be a valuable addition to my course content."* In recognition of these concerns, we propose a three-layered pyramid framework (Fig 1) for introducing PBT in college classes.
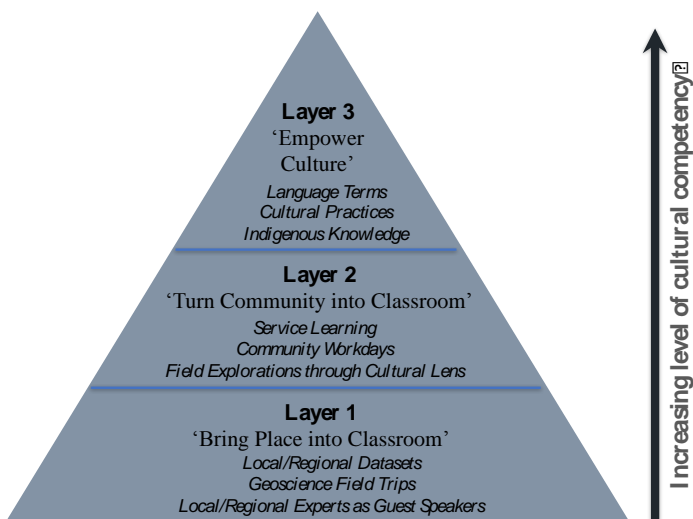
Fig. 1. Three-layered pyramid framework for introducing place-based teaching practices into the classroom.

Faculty can start with the sample practices noted in the base layer, and progress upwards as their cultural competency and place attachment deepens. The base layer describes easy-to-implement PBT practices that bring place into the classroom, and that do not require deep cultural knowledge or community connections (*e.g.,* using local/regional data sets or geoscience field trips). The middle layer involves turning the community into a classroom, and requires a higher level of community connections (*e.g.*, service learning projects, field trips that integrate indigenous culture with Western science). The highest layer (*e.g.*, incorporating indigenous knowledge or cultural practices) requires considerable cultural competency. While some non-local faculty might never feel it is culturally appropriate to explore this third layer on their own, they might feel more comfortable partnering with others, such as local or indigenous faculty or community members. In this way, faculty can progress along the continuum as their understanding deepens, and mitigate the inherent risk of cultural appropriation and mishaps. To encourage SOEST faculty to continue to use PBT in their courses, as well as to diversify their PBT practices, we have begun to assemble place-based geoscience resources (both physical and electronic). These include: field trip guides; local and regional datasets along with activities using these datasets; recommended community organizations and members to partner with; service learning opportunities; and a range of Hawaiian language and cultural resources. To date, we have established a physical lending library of books and videos on Hawaiʻi-relevant topics and place-based pedagogical practices for SOEST faculty. We furthermore have a pending proposal to build on these nascent efforts. If funded, we will: (1) create an expanded library to serve all UH faculty (not just SOEST); and (2) organize PD trainings, including fieldtrips and workshops, co-led by *kupuna* and other cultural experts, for SOEST and UH-wide faculty to further develop their sense of place. By doing so, we envision faculty incorporating more varied and meaningful PBT practices into their classrooms as their knowledge deepens and hence, making SOEST courses more attractive to NHPI students. In Fall 2020, we intend to evaluate the impact of these efforts on PBT by re-administering this same survey to SOEST students and faculty, and comparing these results to the Fall 2018 benchmark data (Tables 1-2) using standard statistical methods. Although each place is unique, the concept of PBT is universal and we invite collaborations from other research groups interested in testing this methodology in their locale.

5. Conclusions

We surveyed 59 faculty and 81 students at UH Manoa in Fall 2018 to explore PBT practices in SOEST. Survey results indicate that the overwhelming majority of faculty (83%) and students (78%) consider PBT an important and effective strategy for all students. Despite most SOEST faculty not being from Hawaii, virtually all use at least some PBT in their courses (*e.g.*, 91% report using local/regional data sets) with faculty comfort being

key indicator of which PBT strategies they use. Importantly, students and faculty report wanting to see more PBT practices in future semesters. However, the PBT strategies that faculty would like to use in the future (e.g., indigenous knowledge and service learning) broadly correlated with lower comfort ratings (*e.g*., 2.9-3.5). We therefore propose a three-layered PBT framework, where faculty can progress upwards as their cultural competency deepens. Through providing geoscience resources and professional development opportunities, we empower faculty to further develop their sense of place, so they incorporate more diverse and culturally meaningful practices in future courses.

Acknowledgements

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Using student-led manufacturing in makerspaces to support transition into engineering higher education

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Abstract

This paper reports our preliminary findings from utilising The iForge, a student-run makerspace, as a resource for curriculum-based learning, in place of traditional timetabled workspace access for students. We show how this enabled us to offer projects that were less structured, less constrained by timetables, and more open-ended. We also explain how we were able to embed the development of professional skills – particularly teamworking – into the curriculum. Results show no negative impact on student satisfaction or grades, and positive impact in terms of staff time and flexibility for students to work independently around their individual timetables. We conclude by highlighting some areas for further work, and make recommendations for colleagues wishing to explore more creative practical projects in their own contexts.

Keywords: makerspace; design; manufacturing; professional skills.

1. Introduction

For the majority of students beginning an undergraduate degree in engineering in the UK, the discipline is new, since it is not offered as an A-Level subject. Science and maths form the basis of admission to most engineering programmes. However, we have learnt through recent student engagement work that students expect engineering to be fundamentally different from those pre-requisites in that they anticipate engineering being about doing and not just knowing; they expect to gain practical experience of putting knowledge to work (Wood & Gibbs, 2019). Industry partners also highlight the value of practical skills in engineering, when they report skills gaps between their expectations of new graduates and graduates' actual capabilities (Royal Academy of Engineering, 2010). A challenge for engineering educators working with first-year undergraduates is therefore to help students transition into a new discipline, whilst building foundational knowledge, technical and professional skills that enable success in studying and beyond. Responding to this challenge requires us to rethink traditional approaches to teaching engineering, where the focus in the early part of degree programmes is on engineering science, with limited opportunity to apply it.

In 2017, inspired by visiting the Invention Studio at Georgia Institute of Technology and by students' desire to *do* engineering instead of just *learning about* it, we worked with a team of students to launch a student-led makerspace. The iForge encouraged students to use and develop their skills through competitions and themed events. As we observed students using the space, working and learning together, we gained a better understanding of how our students most effectively learned to be engineers. We began to reimagine curriculum-based practical teaching, seeing new opportunities to enhance learning whilst overcoming barriers to large-scale, in-curriculum practical projects.

This paper reports our preliminary findings from utilising a student-led makerspace as a resource for curriculum-based learning. In the spirit of Wilczynski (2015), who notes the need to document and share best practice as we develop UK makerspaces, we show here how The iForge enabled us to offer projects that were less structured, less constrained by timetables, and more open-ended. We explain how we were able to embed the development of professional skills – particularly teamworking – into the curriculum, and the value we have seen in explicitly teaching students these skills, rather than assuming students would develop them through experience alone. We conclude by highlighting some areas for further work, and make recommendations for colleagues wishing to explore more creative practical projects in their own contexts.

2. The iForge at The University of Sheffield

The iForge provides students with access to 3D printing technology, laser cutters, a CNC router, bench-mounted power tools, and hand tools. Materials and components are available

for purchase using student cards, so they can be charged either to teaching budgets or personal funds. A select team of trained student 'Reps' runs and manages the space, providing training and supervision for students using it. They each volunteer three hours per week to open the space for 40 hours each week, supervising and supporting other students, and in return they are permitted 24-7 access to the space.

Alongside a desire to provide space for enterprise activities and extracurricular groups, we hoped that The iForge would improve students' experience of current design and manufacturing teaching and encourage the design of new self-directed manufacturing experiences. After a couple of pilot activities, it was clear that there were benefits to using The iForge to support curricular activity, including a reduction in staff hours required to supervise student projects, and increased student motivation. Over the summer of 2018, The iForge was expanded from an initial space of 90m^2 to around 250m^2, in preparation for our wider usage of the space to support a new Mechanical Engineering module.

3. Reimagining first-year design and manufacture projects: A case study of MEC115 Design and Manufacturing

Traditional approaches to design and build modules provide schedules classes in a staffed manufacturing space. We recognised a number of problems arising from this scenario:

- Difficulty accommodating increasing cohort sizes in very full timetables, leading to some groups manufacturing out of phase with each other;
- Manufacturing processes and materials being limited, due to lack of available supervision or equipment, which in turn limited the project scope; and
- Lack of support to help students scaffold and plan the process, and lack of communication between departments, leading to excessive pressure on resources as deadlines approach.

In 2018-19 we redesigned our first-year Design and Manufacturing module, seeking to address the challenges identified immediately above by using The iForge, whilst providing more structured scaffolding for the development of teamworking skills.

3.1. The project

The redesigned twelve-week module presented students with a brief to design, manufacture, and showcase three novel, compact and low-powered musical instruments.

The stated aims of the module were that students should:

- develop an understanding of design methodologies applicable to engineering products;
- learn to employ design techniques and methodologies in the creation of a device to fulfil a given function; and

- gain a basic understanding of customer needs, marketing, and enterprise.

3.2. The students

A cohort of 149 first-year mechanical engineering undergraduate students were enrolled in the module. We divided them into teams of approximately 12 and tasked them with determining their own internal structure and creating a project plan to meet the brief.

3.3. Training and support

Previous module evaluations demonstrate students' dissatisfaction with team activities and desire for grades to reflect individual performance. However, employers and accrediting bodies require graduates to be able to work effectively in teams. We sought to address this problem by equipping students with skills to manage the process as well as the output of the project.

In the first two weeks of the module, students engaged in workshops exploring effective teams, team roles and dynamics, and project planning; and tutorials on creating Gantt Charts to structure and manage projects. At the end of the initial six-week design phase, students completed a formative peer assessment. This formed the basis of individual feedback to students. In addition, a mid-point point tutorial gave each group the opportunity to discuss and reflect on teamworking with a module tutor, and thus to address any issues that were arising.

3.4. Design and manufacturing

In the first six weeks, in addition to the professional skills training and a sketching class to help them to communicate their ideas, the students developed their design concepts. During this time each group was required to book a review with staff to discuss the progress of their design, groups submitted an 'Ideation Report' which acted as a milestone to ensure they had converged on their designs.

In the next stage, the students developed, built, tested and refined their designs, with another mid-stage review to check progress. Teams were encouraged to organise themselves to manufacture their instruments in The iForge at a time that suited them, with no timetabled manufacturing sessions. They had approximately four weeks after submitting the Ideation Report to complete the manufacturing and testing of their prototype instruments. Each group had a budget to manage, which could be spent either in The iForge or by requesting specialist parts through an online form. Supervision was provided entirely by iForge Reps, who were available to provide advice on design and manufacturing. Technical support from staff was confined to the organised review sessions.

Each group created a crowdfunding video and performed with their musical instruments in front of the whole cohort, who voted on various aspects of the instruments and

performance. A final report was produced consisting of an evaluation of the manufacturing process and the instruments themselves.

4. Results

We used several measures to consider the impact of the innovations described on three important areas: the student experience, as evidenced in student evaluation data and engagement in manufacturing; the extent to which the module aims were achieved, as evidenced in student attainment; and the effect on staffing costs and space requirements.

4.1. The student experience

Student satisfaction data from the module evaluation surveys for were compared with equivalent data for the same module two years previously, prior to the introduction of the makerspace. Amongst other things, students were asked to rate their satisfaction from 1 (very dissatisfied) to 4 (very satisfied). The average rating in 2016-17 was 3.07 (n = 153, SD = 0.527), whilst the average in 2018-19 was 3.16 (n = 100, SD = 0.604).

To explore these data further, we entered them into a one-way between-subjects analysis of variance (ANOVA), with student evaluation ratings as the dependent variable and *year* (*2016-17* or *2018-19*) as independent variables. This test revealed a no significant main effect of *year* ($F_{(1,253)}$ = 1.376, p = 0.242, partial η^2 = 0.005), confirming that students' satisfaction with the module was not significantly different between the new model in 2018-19 and its previous format, without the makerspace, in 2016-17.

In the four weeks preceding the deadline, 80% of the cohort used The iForge, for an average of 9.9 hours each, engaging in a range of processes from CNC routing to 3D printing and soldering, creating a variety of outputs. In previous years, students were timetabled six compulsory hours in this period, plus another six optional hours, but many of these sessions were not fully utilised, and the flat spaces provided generally limited the students to the use of hand tools.

4.2. Meeting the module aims

We analysed student attainment using students' final module grades. The average grade for students in 2016-17 was 66.34 (n = 231, SD = 8.169), whilst in 2018-19 the average was 64.64 (n = 147, SD = 12.381). These data were entered into a separate one-way between-subjects ANOVA, with *grade* as the dependent variable and *year* as independent variables. This test revealed no significant main effect of *year* ($F_{(1,376)}$ = 2.582, p = 0.109, partial η^2 = 0.007), confirming that student grades were not significantly different between the two academic years.

4.3. Staffing costs and space requirements

In 2016-17, 68 hours of technician time plus 390 hours of Graduate Teaching Assistant (GTA) time were used. In 2018-19, the use of student supervision in The iForge meant that only 76 GTA hours were used with around 12 hours of technician time. However, queues in excess of four hours in the final week led to us scheduling staffed spaces for students to use ad-hoc during certain hours.

5. Discussion

5.1. The student experience

Although results do not show an increase in satisfaction, the finding that satisfaction remained unaffected, in spite of the reduction in staffing levels, is a positive outcome. The community feel and student supervision model of the makerspace is surely a more appealing environment for the students and contributes to a better experience, resulting in high levels of engagement with the space. This benefit was, however, somewhat tempered by students having to wait to use the space when demand increased close to deadlines.

5.2. Meeting the module aims

Given the changing nature of module assessments from year to year, it is difficult to draw strong conclusions from the attainment data. However, the increase in creativity and variety displayed in the final outputs indicates better engagement with the ideation stage of the design process, which was helped by allowing a greater range of materials and processes. The fact that the manufacturing is carried out in an open environment alongside extracurricular activities means that "students from a variety of academic programs use the space and, as a result, offer diverse perspectives for amplifying creativity and solving problems," (Wilczynski, 2015).

The self-directed learning approach meant that groups had to organise their own schedules, giving a more realistic experience of the design and manufacturing process in industry. Although they may find this uncomfortable, it ultimately benefits their employability.

The integration of professional skills teaching, design theory, and practical application appears to have been successful, although the final outputs would have benefitted from further integrating engineering science to be able to more fully explore instrument design.

5.3. Staffing costs and space requirements

Wiczynski (2015) asserts that 'aligning access times with the student work schedules increases the utility of academic makerspaces'. In this case, the extensive availability of The iForge, particularly outside class hours, allowed students to fit access around their class schedules, and thus The iForge was at capacity throughout its opening hours for the final few weeks of the

project. This increase in demand, while a positive sign of high levels of engagement, put pressure on space resources, and suggested that expansion of the facility would be required to continue to support and expand self-directed curricular manufacturing experiences.

The associated benefit, however, was that staffing costs were greatly reduced. Wilczynski also claims that 'the impact of an academic makerspace on a campus correlates with the staff support provided in the space'. But successful student-run makerspaces such as the Invention Studio at Georgia Institute of Technology, and now The iForge, prove otherwise. Our experience is that students appreciated the specialist knowledge and enthusiasm of student Reps, and it allowed staff with extensive technical expertise to be better used elsewhere in the design process as facilitators rather than gatekeepers, to advise on design and manufacturing rather than police health and safety.

In response to the challenges of student expectations and their inexperience with self-directed learning, high levels of scaffolding were introduced, through professional skills teaching and regular reviews, in order to support the transition from more structured learning environments. It is envisaged that the level of support would gradually be reduced as students move through the course, encouraging them to seek out information and learn required skills for themselves.

6. Conclusions and recommendations

A number of papers have examined role of academic makerspaces in learning. Sheridan *et al* (2014) compared three makerspaces and concluded that:

> While it may be easier to design, teach, and study more constrained 'making activities', the learning in the making we observed in our studied makerspaces extends beyond this. Being a maker in these spaces involves participating in a space with diverse tools, materials, and processes; finding problems and projects to work on; iterating through designs; becoming a member of a community; taking on leadership and teaching roles as needed; and sharing creations and skills with a wider world.

The student-run Invention Studio provides a good model for this, much of which has been taken on at The iForge, but academic staff at The iForge have also proactively engaged with module leaders to create early self-directed curricular design and build experiences across the Faculty of Engineering. We have also looked to change the paradigm for teaching manufacturing. This is described well by Schön *et al* (2014):

> Looking at the teacher in a maker setting, it is obvious that traditional teacher-centred teaching does not fit. Typically, teachers in maker settings change their role to facilitators and enablers … from leading to support and tutoring … [S]tudents may be better or more experienced in one of diverse tools... But even more important, the openness of the setting

and the creative results within this approach may lead to situations where the students may be better as the teachers... This can be challenging as well as motivating and surprising for teachers. For students, it is the chance to see teachers as inspirational partners as well as models for their own learning.

Our case study also shows that professional skills are more effectively learned when embedded in the context of a real project. Students will not see the relevance of teamworking skills training until they have experienced the peculiar challenges of designing within a team of engineers.

Using a self-directed approach to design and manufacturing bolsters learning in a number of important ways, and does not have a detrimental effect on student experience or attainment, despite being a much more efficient and scalable solution in terms of staffing and space requirements. However, it is important to consider the impact on teaching staff and to emphasise the benefits over the perceived challenges. Sharing good practice and successes will add to the body of evidence that student-led makerspaces can and should play an important part in effective teaching of design and manufacturing in HE.

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Innovations in the Development of Critical Thinking and the Teaching of the Nature of Science and Technology: Background and Proposal for Food Engineering Course of Studies

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Abstract

This paper presents an analysis of the innovations made in scientific and technological courses of studies about STS education and it presents, as an example, the proposal of a Didactic Unit to teach Nature of Science and Technology and to develop Critical Thinking in Food Engineering students. The proposal is part of an international project on education of the technological and scientific competences and critical thinking by teaching topics related to nature of science and technology, in which different Ibero‑American countries participate. The implementation methodology of the didactic units is validated, and multiple positive results have already been achieved in different courses. For this particular case, a didactic unit called "A Food Engineer at the Zoo" is proposed for the course of Food Preservation and it is intended to work with the Problem-Based Learning methodology with the aim of developing different generic engineering and critical thinking competences.

Keywords: Innovations; Nature of Science and Technology; Critical Thinking; Food Engineering.

1. Introduction

Natural Sciences teaching has been changing over time in order to decrease students' lack of interest to learn them (Solbes, Montserrat & Furió, 2007) and to reverse the trend towards the widespread increased rejection of scientific issues (Vázquez Alonso & Manassero Mas, 2009).

Therefore, it becomes essential, among other things, to innovate in sciences teaching and to include aspects of Nature of Science and Technology (NST) in training students from scientific and technological courses of studies. As stated by Cordero, Dumrauf, Mengascini and Sanmartino (2012), people should shift the focus of the problems to be studied, which are traditionally extracted from the same institution and not from the social context. Thus, it becomes crucial to include not only the sciences history, but also the technology history in the treatment of problems to improve the general understanding of the nature of technology (Acevedo Díaz, 2010).

The NST is a metacognition group about the functioning of science in today's world which includes multiple reflection areas of knowledge such as sociology, history, philosophy and epistemology. The main objective of the NST is the construction of scientific knowledge including issues of the aforementioned areas in order to understand relationships among Science, Technology and Society (STS). The NST is closely related to the STS movement and it is convergent with the same approaches for education in science and technology (S&T) (Spector, Strong & Laporta, 2002).

This paper mentions innovations made and describes, as an example, an approach from the National University of Quilmes to improve understanding of the NST and to develop critical thinking (CT) in students from the Food Engineering course of studies, more specifically, within the course of Food Preservation through the incorporation of a Didactic Unit (DU). The approach is part of a doctoral thesis on food education and critical thinking development within the framework of the CYTPENCRI project -Education of scientific, technological and critical thinking competences by teaching nature of science and technology themes (Project EDU2015-64642-R (AEI/FEDER, UE) funded by the Spanish State Research Agency and the European Regional Development Fund.). It is an international project shared by different Ibero-American countries.

2. Development

2.1. Background

Within the National University of Quilmes investigators have developed extensive research on the incorporation of DU on NST contents in the curricula of scientific-technological

courses of studies. The research has been carried out in the area of Chemistry (Porro, 2013; Porro & Roncaglia, 2016) and within the didactics of natural sciences area for the Bachelor in Education course of studies (Porro & Roncaglia, 2016). In all cases, positives results have been obtained by statistically assessing the intervention.

 Meanwhile, from the perspective of graduates, employees and professors, a lot of research has been carried out related to the competences to be developed by graduates of the Science and Technology department from the University.

 Specifically within the Food Engineering course of studies, a study has been conducted on the incorporation of animal feed contents into the food engineering curriculum (Lampert, Russo & Porro, 2017) and room interventions within the course of Food Preservation.

The development of DUs for the CT development has some background within the Food Engineering course of studies (Torrecilla, Aguado, Tijero, Ballesteros, Moral, & Lastra, 2018) based on the assumption that imaginary problem resolutions enhance students' critical thinking skills (Alharji, 2010; Shen, 2012).

2.2. Food Preservation Course

Food Preservation is a compulsory course from the last year but one belonging to the Food Engineering course of studies. Among its minimum contents are the physical, chemical and biological methods for food preservation, raw material conditioning, food storage and transportation and minimum processing. In the course, various DUs with NST contents have already been implemented, such as the work done on the history of food preservation and the production and packaging of hydroponic foods in conjunction with a dissemination project from the University (Dron, Balboa, Lampert, Verdecia & Porro, 2018). In both cases, CT was encouraged through argumentation.

At the beginning of the course and by means of the analysis of food packaging and transport, special emphasis is placed on food of plant origin and on milk. This way, students are introduced to the concept of foodborne zoonoses. In a previous course, Food Microbiology, Foodborne Diseases (FD) are developed. However, the treatment of zoonoses and parasitic diseases transmitted by food is not included within the minimum content.

Therefore, zoonoses and FD treatments are to be modified, which are currently developed in an expository manner, from the incorporation of a DU which includes NST aspects and also allows CT development.

To achieve this, this paper proposes the creation of a DU based on students' ideas about FDs and Zoonoses, students' standards on expected reactions based on research, characteristics and contents of the NST domain, epistemological assumptions, learning

perspectives, current pedagogical approaches, and characteristics of the professional competences of food engineering students. UD development is based on the application of Problem-Based Learning (PBL) methodology. In this sense, starting from an either real or fictitious problem, students must resort to various tools in order to find a solution (Branda, 2009).

2.3. DU Development

As previously stated, it is necessary to outline an unusual situation to facilitate CT development (Alharji, 2010; Shen, 2012). Therefore, an example is presented in which a Food Engineering professional has to advise on the zoo implementation and to prevent people from contracting FD and zoonoses. This way, it is intended for students to be able to relate different engineering competences (Table 1). The activity will be developed in 4−member groups, and the results will be shown at the end of the research.

Table 1. Competences to Be Developed by Students from the DU

Competence Type		Solution Example for the Proposed Problem
Technological	To identify, formulate, and solve engineering problems.	To identify that the problem is that society lacks knowledge of FD and Zoonoses prevention. On this basis, decision making begins. For instance, all visitors are subject to a prior briefing before entering the zoo.
	To comprehend, design, and develop engineering projects.	To develop a 3-sector zoo plan: one of animal contact, another of non-animal contact, and an intermediate one. The buffet and food court will be placed in the second sector so that people can enjoy a snack. In the third case, hand washing sinks with the relevant chemical substances will be installed to avoid contamination when entering into the non‑animal contact area.
		Likewise, since people spend several hours in direct sunshine, it is important to highlight what kind of products should be sold and how they should be packed.
	To effectively use engineering techniques and implementation tools.	To prepare no-food or no-drink signs in the area of contact with animals and no-children-with-toy signs due to the risk of falling in areas where free animals are.
Social, political and attitudinal	To perform effectively in work teams and to learn in a continuous and autonomous way.	To work together with other professionals: Veterinarians, Biologists, Ecologist.
	To proceed in an ethical manner with professional responsibility and social commitment.	To avoid using fences in order to separate animals from human space, since there can often be traces of animal saliva, fecal matter or vomit. To replace fences by moats or glass enclosures to also reduce visual pollution caused by fences and to provide a view of the animal's natural habitat.
	To communicate effectively.	To present solutions with certainty and solid arguments to employers to hold the stance.

Source: Prepared by the authors based on second generation standards approach for the Engineering courses of studies accreditation in the Argentine Republic "Libro Rojo de CONFEDI".

Within the NST framework, adopting the category proposed by Vazquez Alonso (2014), working on a zoo implementation would improve the understanding of the external sociology of science and the triadic influence among Science, Technology and Society: society influence on science and technology (in this case to prevent FD and zoonoses), science and technology influence on society (engineering competences and tools to do search) and the technology social construction (considering the zoo design will be based on society knowledge). Below there is an outline as summary of the contents linked to these problems (Figure 1).

Disciplinary Contents	External Sociology of Science Contents	Technological and Scientific Contents	Epistemology and History of Sciences Contents
• Notions of food safety, Zoonoses and FD, food handling, Good Manufacturing Practices (GMP), hygiene and safety principles and environmental engineering	• Biodiversity preservation: strategies. Zoo visit objectives: educational aspects. Environmmental justice. Society and nature relationship.	• Science and technology influence on society, society influence on science and technology for social problems resolution.	• Zoos ethical aspects. Zoos' paradigms and objectives shift.

Figure 1. Summary of Disciplinary Contents and UD NST. Source: prepared by the authors.

On the one hand, the decision-making and problem solution skills will be worked in relation to CT (Halpern, 2014).

The didactic sequence will be developed in four stages, one week each.

First On-site Stage: zoonoses and its significance for food preservation is presented. The problem and critical questions that guide the research are set out.

Problem: A food engineer at the zoo.

"A food engineer is hired to help set up a zoo. However, the job was not focused on advising on the dining room, but on monitoring and advising on FD and zoonoses when people were in contact with animals and, in turn, manipulated food. It is worth mentioning that the good state of health of animals is a job already controlled by veterinarians. Nevertheless, diverse microorganisms are present in animals and are asymptomatic for them".

Critical questions (they should not be answered, they are part of a guide to orient the search for a solution to the problem):

   a- As professional engineers, what are the aspects to consider on a zoo visit that may lead visitors to contract a disease?

b- What engineering tools and techniques would be used to prevent FD and zoonoses when visiting the zoo?

c- Would you work alone or in group? If you choose "in group", what professionals would you choose for your team?

d- What considerations should be taken into account by the Food Engineering professional when drawing up the zoo?

e- What food engineering competences are at play when searching solutions?

f- Make a list of the points that you would explain to your authority and their respective rationale.

Second and Third Virtual Stages: opportunities for enquiry and follow up by professors in solving the problem.

Fourth On-Site Stage: problem solutions presentation and debate among different groups will be carried out.

3. DU Application Perspectives and Conclusions

DU application on NST has achieved several positive results in the investigations carried out, improving argumentation skills and incorporating NST contents. Therefore, it is important to continue with this kind of methodology that also allows students to relate to other fields of knowledge.

The application of the proposed UD will begin to be implemented during the first quarter of 2019; however, the proposal was presented to 12 professors from the 4 educational levels in order to get their opinions, and it was found that 100% indicated that the UD is very important to acquire scientific skills, 90% that what was learned was very useful, 100% that it motivates and 90% that it allows to be more critical.

The UD application methodology, in the same way as the previous ones, is based on CYTPENCRI project. For this, two tools will be used. On the one hand, the Opinions Questionnaire on Science Technology and Society (Spanish acronym COCTS), a questionnaire consisting of 100 questions empirically designed from students' answers, in a non-technical language on a scenario to evaluate a particular feature of NST, and it suggests several sentences of judgments, where the person surveyed assesses their degree of agreement with each phrase. On the other hand, a validated test on CT development will be used. Both tools have a similar structure that ratifies the parallelism between the CT skills and the scientific thinking skills assessed by the COCTS. The experimental group receives the (DU) treatment, while the control group does not receive the treatment, but both groups

are administered the evaluation instruments before (pre-test) and after the moment of treatment (post-test).

It is important to incorporate this type of pedagogical initiatives in the dictation of subjects of scientific-technological courses of studies since, by the results obtained in the already carried out investigations, they allow to improve NST comprehension and the general competences of engineering from the CT development.

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A Project-based learning for the subject "design and implementation of databases"

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Abstract

Project-based learning is a technique that uses projects to develop the learning process. This technique is being used in several matters and disciplines providing very good results. In this paper, a project-based learning is presented to improve learning in the subject: design and implementation of databases.

Students work in groups of four people. The activities are developed not only in the classroom (theory, problems and laboratory) but also as homework. Furthermore, during the project development, each group has to have individual interviews and discussion with the teacher to analyse the project evolution.

Despite the marks obtained in the project, where laboratory sessions, and the exam improve slightly the marks of previous year, it could be considered that the development of the project is very positive considering the improvement of the percentage of student's success. The enquiry developed at the end on the semester also shows that the project supports student in the learning process.

Keywords: Project-based learning; Computer Science; Databases.

1. Introduction

A database is a set of data stored in external memory that are organized by a data structure. Each database has been designed to meet the information requirements of a company or other organization, such as a university or a hospital (Marques, 2011).

In the Computer Science degree of University Jaume I, there are several subjects related to Databases. An introductory subject to databases is studied in the second semester of the first year. In the fourth year of the degree, students must choose subjects grouped in four subdisciplines of computer science: Software Engineering (SE), Information Systems (IS) Information Technology (IT) and Computer Engineering (CE). There are three different subjects that go deep in the databases matter. These subjects depend on the subdiscipline. Table 1 presents detailed information of these subjects, including credits, year, semester and type (compulsory or optional).

Table 1. Subjects directly related to Databases in the Computer Science degree of Universitat Jaume I.

Code	Subject	Subdiscipline	Credits	Year	Sem.	Type
EI1020	Databases	-	6	2nd	2nd	Compuls.
EI1038	Design and implementation of databases	IS	6	4th	1st	Optional
EI1041	Design of databases systems	SE	6	4th	1st	Optional
EI1052	Database management syst.	IT	6	4th	1st	Optional

Subjects EI1038 and EI1041 have the same curricula and competences, Thus, students of two intensifications share classroom, contents, teacher, lectures and evaluation.

In this paper, the work developed in both subjects are presented (henceforth, the subject is related to EI2038 and EI1041). The subject was designed and planned following the Bologna recommendations and the experience gained in the subject design and management of databases from the old degree of Computer Science.

This subject is studied in the first semester of the fourth year of the degree. In the subject, the design of databases is studied deeply, focusing especially on the logical and physical design of databases. In addition, the database design must be able to include the evolution of the information, turning it into an active database. The subject is structured in three types of sessions: theory, problems and practice in the laboratory. Theory and problems sessions are structured in 13 lectures of 1,5 hours' duration. Practice sessions are structured in 9 lectures of 2 hours.

The subject objective is to go deeper in the design and development of relational databases to model information systems. So, the main competences are: a) the ability to solve problems of information integration; b) the ability to integrate IT solutions and business processes and c) the ability to participate actively in the specification, design, implementation and maintenance of information systems.

2. Project-based learning

Project-based learning is a technique that uses projects to develop the learning process (Thomas, 2000). In the last 15 years, this technique has been used in several disciplines and education levels, especially in high schools and university degrees. Some examples were presented in Herper and Stahl (2003), Connolly and Begg (2003) and Nattassha and Azizah (2015).

Andrew Miller (2016), describes some basic tips to define PBL. These tips are: a) assess community needs, b) align content and skills, c) learn from each other, d) reflect often, e) create an action plan, f) evaluate the Impact, and g) celebrate Success. Valero-Garcia and Navarro (2008) identified three elements to define a PBL: a) the formation of project groups, b) the problem description and c) the student workplan and the learning objectives and competences.

Following these recommendations (tips and elements), a project-based learning approach has been used to develop the subject's activities (theory, problems and laboratory sessions).

3. A project to reach subject competences

In previous years, before the introduction of PBL, the activities that students had to carry out were not related between them, so that activities for the theory class were designed in order to understand more theoretical concepts, while activities for the laboratory class intends to apply these concepts in practice.

Currently, the PBL is the subject backbone, most of activities and lab practices are related to the project. Furthermore, homework, both individual and in group have to be done. The project consists in the complete design of a database for an enterprise, from the requirements description till the implementation in a real DataBase Management System. It is based on a real information system. However, in order to fit with the hours in the subject workplan, the information system has been reduced and it does not cover all the information system.

In 2018/19, the enterprise is focused on a private academy that offers courses of different matters and levels. The information system has to model the students, the different types of

employees, courses, exams, classes and timetables. Other information as accounting, sales… is not included in the project information system.

The project is developed in groups of three or four students. The group formation is free, only one rule has to be fulfilled: all group members must have, at least, one free hour in common during the week. This hour will be used, if needed, to hold physical meetings.

3.1. Project activities

During the development of the semester, students must develop 29 different activities (including lab activities). 8 activities and 2 lab sessions are basic learning activities used in the introduction of theory and lab sessions. The rest of activities are related to the project. 12 activities performed in the classes devoted to theory and problems, and 7 activities are practices which are performed in laboratory sessions. Table 2 shows the id number, the name and the description of the activities.

Table 2. Project activities. Activities are presented in chronological order.

Id	Activity	Description
5	Requirement description	The enterprise model is presented. The students perform the requirements of the information system.
6	Evaluation of requirements	Each group evaluates the requirements performed by another group. A rubric is provided. Finally, a common project requirements are agreed.
7	Conceptual design	Following the requirements identified in the previous activity, the conceptual schema is developed.
8	Evaluation of Conceptual design	Each group evaluates the conceptual schema of another group. A rubric is provided. Each group is able to work with its own proposal. Discrepancies are solved in the blackboard.
9	Logical design	The logical design of the conceptual schema is developed.
10	Evaluation of the logical design	Each group evaluates the logical design of another group. A rubric is provided. Each group is able to work with its proposal. Discrepancies are solved in the blackboard.
11	Physical design (CREATE TABLE)	The physical design is developed. Each group chooses the DBMS to implement the database (Oracle or PostgreSQL).
P2	Database Implementation	The designed database is implemented in one laboratory session. This activity is developed individually. Moreover, data has to be inserted in the database.
13	Views	A first approach of the possible database views are created.
P3	Triggers. Identity rules	A laboratory session is developed to control the integrity rules of the courses offered by the academy.
14	Modifying the model	A new computed attribute is added to one table. Then, the triggers to maintaining it always updated is developed.
15	Roles	Project roles are identified. Students must create these roles and manage the different user permissions.
P4	Triggers for auditioning	The updates performed in the employees of the academy have to be audited. New audit and historic tables are added to the model. Furthermore, several triggers are developed to maintain automatically these tables.
P5	Triggers. Business rules	This laboratory session is focused to develop different business rules (for example, to control the number of students engaged in the course). Each member of the group has to implement one different

		rule.
P6	External schemes and views	This laboratory session is an extension of activity 13. The final external schemes are implemented. Each member of the group has to implement different views.
16	Indexes	An activity to analyse the different indexes to make faster the database access is developed.
P7	Triggers.	More business rules have to be implemented using triggers.
P8	Triggers and views	In this laboratory session, students have to create triggers to make updatable the different views created in the external schemes.
20	Project document	In this activity, the group has to create a document including all the work developed during the course related to the project.

3.2. Project competences

The development of the project improves how students acquire the subject and degree competences, not only specific but also basic competences.

The specific competences are:

- The ability to solve problems of information integration is trained in the whole project, but specially in activities 5 and 7 where the problem is analysed and defined.
- The ability to integrate IT solutions and business processes are reached in activities and practices, where specific processes are proposed and solved.
- They acquire too the ability to participate actively in the specification (activity 5 and 6), design (activities 7-11), implementation and maintenance of information (activities 11-16 and practices).

The basic competences are:

- Synthesis and analysis capacity. This basic competence is acquired in all activities, but mainly in activity 5 and 7 where the analysis and scope of the project is defined.
- Problem resolution. The whole project implies to know how to solve a problem. Furthermore, activities 7, 9, 11 and practices stimulate this competence.
- Autonomous learning. The project encourages the autonomous learning and critical thinking in two ways: a) Students must provide their own solutions in different activities, so they have to look for and propose new problems solutions

and b) some activities are evaluated by other groups, so students learn, from other students, different problem solutions.

Furthermore, during the development of the project activities, students work with different software tools to model, design and implement the database. In concrete, to develop the conceptual model students use *Dia*. To develop the logical design, they use *Vertabelo* software and finally, the database could be implemented in *Oracle* or *PostgreSQL*.

3.3. Project assessment

The project assessment is done during all the semester. The deliverables and results developed by each group (related to different project phases), are evaluated in several ways: a) common review, where activities are corrected in the blackboard; b) a peer review, where groups analyse and evaluate the results provided by other groups (blind review) and c) individual group review, where the teacher corrects and guides individually the different groups.

At the end of the semester, the final mark of the project is calculated following next rules:

- The teacher provides a final project mark (TM). This mark has a weight of 60%.
- The other 40 % is calculated based on the teacher mark, but also considering the own student's evaluation.

4. Results

Table 3 presents the arithmetic mean marks of the subject from 2017/18 and 2018/19 years (first call). Data are presented for the whole subject and individually (EI1038 and EI2041). The marks presented are for lab sessions, project, exam, theory activities and final marks. Moreover, a column indicating the students enrolled and the percentage of students that pass the subject is also presented in the table.

The results show slight improvements. Laboratory and the project are only increased by decimals. Even more, in EI1042 the project mean mark has decreased with the new project. (8,14 vs 7,83). However, the exam and the final mark is increased by 1 unit. The most important result is the percentage of success, the student that pass the subject has been increased significantly.

Table 3. Mean of marks of activities for academic years 2017/18 and 2018/19. Note that final mark is not the addition if the others because it depends on percentage of weights and minimum marks to success.

Subject	Year	Lab	Project	Exam	Theory	Final	Students	Success
EI1038-41	2017/18	8,23	7,91	5,23	9,73	7,69	35	65,7 %
	2018/19	8,34	7,98	6,20	9,68	8,00	25	78,3 %
EI1038	2017/18	8,02	7,35	4,10	9,60	7,13	10	30,0 %
	2018/19	8,38	7,98	5,24	9,64	7,74	7	57,1 %
EI1041	2017/18	8,32	8,14	5,69	9,79	7,78	25	78,3 %
	2018/19	8,32	7,83	6,61	9,70	8,07	16	87,5 %

Nevertheless, two main issues have to be considered with these data: a) there are only one year before and after the PBL deployment and b) the samples are different, not only in number of students, but also in the students' themselves.

This year, once students finished the subject (and they know their marks), an enquiry was done to know their opinions about the subject and the project. 66 % of students answered it (15 students). The results are very positive: major part of students agree that the project is very useful and support them to acquire the subject concepts. Graph 1 presents the results of questions 5 and 6 related to the project and how it improves the subject learning process.
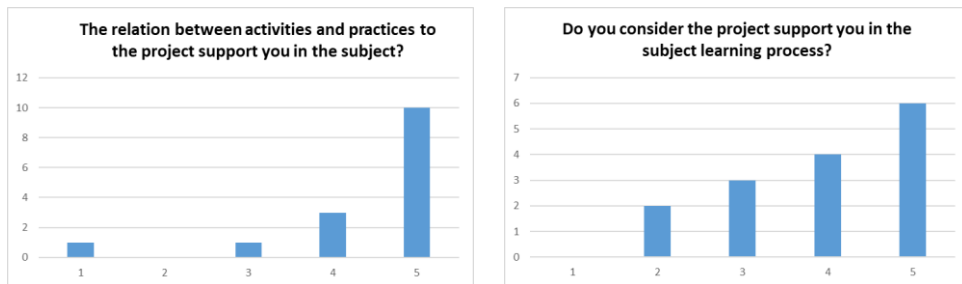
Graph 1. Student's enquiry. Results of question 5 and 6. ("1" imply disagree vs "5" agree).

Furthermore, they also agree that the project is realistic and with an adequate complexity to be developed during the course. The homework time for the project is also considered appropriate. All students consider that the activities are well described and related to the project.

5. Conclusions

Project-based learning is a technique used to do more attractive the learning process. Students acquire knowledge competences and skill working in a project during the subject. In this paper, a project-based learning has been presented for the subject design and implementation of databases.

The project consists in the complete design and implementation of the information system of an enterprise. Most of the activities and laboratory sessions were changed and adapted to the project. Thus, the subject is focused on the project development.

The results are very positive and promising, specifically the percentage of success. Furthermore, students were motivated developing good work habits not only in the sessions but also in their homework. These questions and doubts were used in sessions to improve the activities and the general knowledge.

However, there is room for project improvement. Next year, some modifications will be prepared, taking into account this years' experience and the student's comments. So, all laboratory sessions will be related with the project, modifications and updates of the activities will be developed, and two workshops will also be developed, one at the beginning to explain the project and one near the end of the subject to detail the final task to present the final version of the project.

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Active learning and social commitment projects as a teaching-learning intervention in engineering degrees

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Abstract

The purpose of universities, apart from produce qualified professionals with problem-solving capabilities and soft-skills, should be to develop the social responsibility sense on their students. In this context, our proposal combines project based learning (PBL) and service based learning (SBL) along with gamming and the use of open-source machines, with the aim to increase student's motivation and their social commitment with an affordable budget. The strategy, from now on named OS-PBL-SR (Open-Source-based PBL projects with Social Responsibility), mainly includes three important aspects: (i) assignment with projects orientated towards a social benefit; (ii) development of the projects using open-source Do It Yourself desktop machines (DIY-DkM); and (iii) include gamming in the evaluation method. The strategy was applied in the subject Manufacturing Technology but it might be easily exportable to other technical subjects. The results from the last academic year are presented. Also, a new OS-PBL-SR proposal aimed to the design and fabrication of autonomy-oriented products for people in a dependency situation is presented. The results showed the beneficial impact on undergraduate students by keeping high levels of motivation reflected on excellent success rates and scores. In addition, essential advantages in the use of DIY-DkM were found regarding the implementation of this kind of PBL strategy.

Keywords: Higher education; Project Based Learning (PBL); Service Based Learning (SBL); motivation; open-source machines.

1. Introduction

Contemporary education challenges can be only addressed by innovative approaches. Furthermore, universities of the 21st century have the huge responsibility of produce excellent professional with a high social commitment (Kliksberg, 2009). In this context, our proposal, from now on named OS-PBL-SR (Open-Source-based PBL projects with Social Responsibility), combines project based learning (PBL) and service based learning (SBL), in addition to gamming (Costello, 2018; Gil-Doménech & Berbegal-Mirabent, 2019) with the aim to reinforce knowledge acquisition, increase student's motivation and at same time develop the student's social responsibility. The proposal is complemented by the use of open source DIY desktop machines (DIY-DkM) that brings important advantages and enormous benefits for the implementation of this kind of PBL learning strategies using a reduced budget (Pernia-Espinoza et al., 2017).

PBL promotes the student's active work through challenging and realistic problems (Gary, 2015, Lima et al., 2017). It has been widely used in engineering education in the last decades to improve the learning process and foster students motivation (Castelan & Bard, 2018; Jaeger & Adair, 2018; Frank et al., 2003; Fernandez-Ceniceros et al., 2016). Furthermore, the use of PBL strategies oriented toward a social benefit (SBL) has proven to be even more effective (Bielefeldt et al., 2010; Sienko et al., 2013). SBL propose students to use their knowledge to address a real need from their social environment. SBL promotes critical thinking, problem-solving skills, and helps to develop a civic responsibility in the students (Paniagua & Istance, 2018).

2. Methodology

The methodology is summarized in Figure 1. An 'external petitioner' is involved to promote the use of English language and the Information and Communication Technologies (ICTs) skills. The lecturer responsible of the subject, the 'external petitioner' and other collaborators is what we call along the document the 'Innovation Team'. The 'Área UR-Maker' (www.unirioja.es/urmaker/), the makerspace of the University of La Rioja, provided the appropriated environment to develop our proposal. The UR-Maker is equipped with several DIY-DkM (3D printers, CNC-Desktop machines, etc.) that brings essential advantages and enormous benefits for the implementation of this kind of PBL learning strategies. Some advantages are: lower cost of DIY devices compared to commercial one; safer systems than industrial devices (because of its lower power); smaller than most of the commercial machines; and easy access to the technology as all the information regarding the mechanical design, electronics and software are available to anyone. To complement our strategy, Virtual Simulation tools are provided to the students to simulate the fabrication process before manufacturing the part. In addition, the integration of seminars with experts and visits to local

factories, add value to our strategy. Finally, we included gaming into the assessment strategies to keep students alerted and interested during the semester.
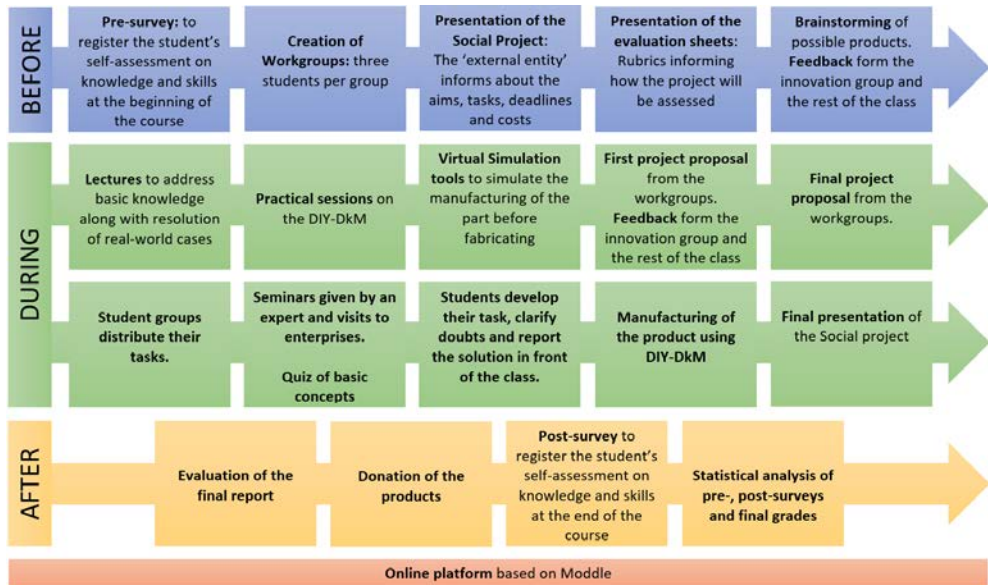
Figure 1. General description of the OS-PBL-SR methodology.

3. An OS-PBL-SR: 'Printing a race toy car'

As an example, we briefly describe the OS-PBL-SR: 'Printing a race toy car', developed during the last academic year (2017-2018). An 'external petitioner' required to each team the manufacturing of a self-propelled (w/o battery) race toy car using 3D printing. Deadlines and costs were also established by the petitioner. The final social aim was to donate the toy cars as Christmas presents for children in low-income families. The software and the DIY-DkM (RepRap 3D printers) recommended for the development of this OS-PBL-SR were all open-source. As deliverables, each team presented its car and provided a final report answering specific questions regarding the design, manufacturing and assembling processes, in addition to information relative to costs and fabrication times. Complementing the evaluation process, each printed vehicle competed with the others in both a race and a design contest.

4. Results and discussion

4.1. Outcomes from the OS-PBL-SR: 'Printing a race toy car'

The groups produced fantastic race toy cars, meeting the requirement demanded by the petitioner. Some students designed their vehicles from scratch, although this was not the

preferred choice. Instead of that, the majority of the groups used models from repositories with some modifications. The competition day was very exciting and the teams were very proud of their printed toy cars (Figure 2).

Figure 2. Pictures of the competition day and all the printed cars in the academic year 2017-2018.

After the competition day, the toys were donated to a charity entity ('*Caritas-Chavicar de La Rioja*') to be part of the Christmas presents for children in low-income families. In addition, the assessment activity based on the gaming platform Kahoot (www.kahoot.it) proved to be a great resource to foster student's motivation and attention during the activities. In summary, this was one of the most excited OS-PBL-SR for the students. As they had to compete with each other, this stimulated their willing to make their best on developing the product. In addition, the social aim of the project added an extra motivation in the students.

4.2. Quantitative analysis of the results

Pre- and post-surveys were conducted at the beginning and at the end of the semester, respectively. These surveys followed the methodology proposed by Rodríguez et al. (2015). Pre- and post-surveys contained questions regarding (i) self-assessment on technical knowledge on the subject (questions on specific competences) and (ii) self-assessment on soft-skills (questions on generic competences). Questions regarding the subject's specific competences (technical questions) were: Q1. I know/understand the basic principles of the machining process. Q2. I know/understand the advantages/disadvantages of the machining process and when is suited to use it. Q3. I know/understand the basic principles of the plastic injection molding. Q4. I know/understand the advantages/disadvantages of the plastic injection molding and when is suited to use it. Q5. I know/understand the basic principles of the welding process Q6. I know/understand the advantages/ disadvantages of the different welding processes Q7. I know/understand the basic principles of the metal forming process. Q8. I know/understand the advantages/disadvantages of the cold and hot metal forming processes. Q9. I am able to design/calculate a basic open-die forging/cold rolling/ blanking/deep-deep-drawing process. Q10. I know/understand the basic principles of the 3D printing process. Q11. I know/understand the advantages/disadvantages of the 3D printing process. On the other hand, survey questions regarding the subject's generic competences questions (soft-skill questions) were: Q1. I have strong oral communication skills. Q2. I have

excellent team working skills. Q3. I have strong team leadership skills. Q4. I solve problems creatively. Q5. I am able to get what really matters from texts and everyday situations. Q6. I manage my time efficiently. Q7. I am a proactive person that propose and implement solutions. The answers were based on a scale ranged from 1 to 4, where 1 represents 'totally disagree' and 4 'totally agree'.

4.2.1. Surveys results from the last academic year (2017-2018)

A total number of 50 students were enrolled in the subject during the last academic year evaluated (78% male and 22% female). There were 45 valid answers (pre- and post-paired samples). The surveys were non-anonymous but confidential. The OS-PBL-SR methodology was applied to all the students.

Students' perception concerning their knowledge about technical aspects of the subject drastically changed after they finished this course (Figure 3). Significant differences were found in all the cases (*p-value* < 0.01). Students seemed to feel more confident in machining, welding and 3D printing areas than others. These results are in concordance with other studies on PBL-based methods (Rodríguez et al., 2015; Estévez-Ayres et al., 2015).
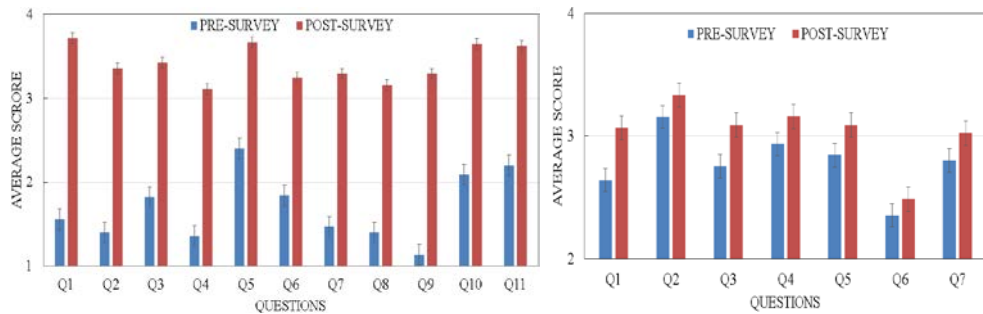
Figure 3. Pre and post-average scores regarding specific competences (left) and generic competences (right).

The non-anonymous surveys enabled us to assess the students' perception of their acquired knowledge after completing the subject. The average of the final score from student's perception (8.5±0.1) was slightly higher than the average of the actual final score (7.8±0.1) per student. An explanation for this could be that student's perception was overoptimistic.

Regarding the generic competences surveys (Figure 3), the scores significantly increased (*p-value <0.01*) at the end of the course in every question formulated. Therefore, the results showed that the students felt more confident on their soft-skills after finishing the subject. This may be considered as an improvement on their self-confidence on soft-skills thanks to the PBL- and SBL-based methodology proposed, somehow also observed by other authors[6, 9, 14]. Oral communication, team leadership, and proactivity resulted in the highest differences. Perhaps, time management would be a target for improving in next experiences.

4.2.2. The success rates and average final score

Previous to the OS-PBL-SR methodology, a PBL methodology based on micro projects was implemented [10]. The success rates and final average scores of students before and after implementing these PBL methodologies (Figure 4) have increased and remained stable during five academic years.
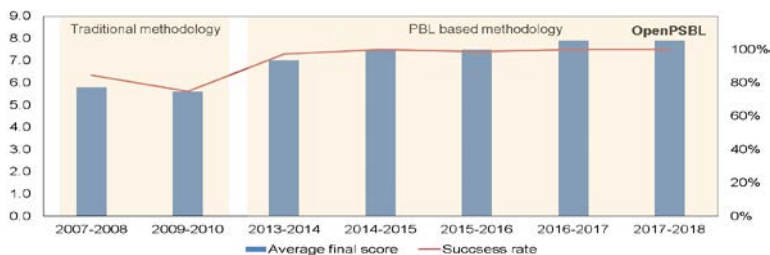
Figure 4. Average final score and success rate in the subject for academic years from 2007 to 2018.

5. New OS-PBL-SR proposal for the current academic year: "Developing of autonomy-oriented products for people in a dependency situation"

The social aim of the project is to design and manufacture autonomy-oriented products for people in a dependency situation. The dependency situation could be caused by a chronic illness or a health-related disability. The final aim is to provide a solution to help people in this situation in activities of daily living. The students proposals should fit into one of the categories established in the UNE-EN ISO:9999:2012. Therefore, the products could help on dressing, bathing, grooming, using the toilet, moving in and out of bed or a chair, and eating. Also, could be products for maintaining an independent life, helping in cooking, cleaning, doing the laundry, shopping, handling money, writing, driving, using public transportation, and using the telephone. The products will be manufactured using both traditional technologies (injection moulding, machining, etc.) and advanced technologies as additive manufacturing which is revolutioning and invigorating today's industry. We strongly believe that in this OS-PBL-SR the brainstorming stage and the feedback during the preliminary project proposal are critical to focus the teams in the development of feasible and useful products.

6. Conclusions

We presented a methodology named OS-PBL-SR based on projects oriented toward a social benefit, intended to increase the students' motivation and develop the social responsibility sense on the students. An appropriate learning environment, with the availability of DIY-DkM, provided important advantages in the implementation of this kind of PBL strategy. The methodology was complemented by the use of gamming, virtual simulation tools, seminars

and visits to enterprises. The involvement of an 'external petitioner' promoted the use of English as a second language and team communication by using TICs. Although the OS-PBL-SR was applied to 'Manufacturing Technology' subject, we believe that might be easily exportable to other technical subjects. The description, outcomes and analysis of one of the most successful OS-PBL-SR during the last academic year was reported. In addition, we described the proposal for the current academic year, intended to provide solutions to people in a dependency situation. Including social reasons and some degree of gaming in the evaluation system highly increased students' motivation. Students' self-assessment concerning their knowledge about technical aspects and on soft-skills drastically changed after they concluded the course. Both results are in agreement with results reported by other authors. In summary, the OS-PBL-SR methodology demonstrated to be an effective method to keep high levels of students' motivation, which was reflected on high success rates and final scores. For further research, the quantitative analysis of the results will be improved by the use of a control group. This control group (composed of students who will not follow the OS-PBL-SR, but traditional methodology instead), will serve as a baseline to compare with. This will avoid possible biases in the aswers to the pre- and post-surveys' questions. Finally, the effect of students' soft skill on the technical knowledge, and vice versa, will be also investigated.

Acknowledgements

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Can we be all in one?

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Abstract

The pursuit of a high research performance is nowadays shared by academics internationally since it is considered to sustain national development. Generating outstanding research is an effort that can jeopardize the enactment of other academic activities and the attainment of related satisfying goals, though. While the interplay between research and other knowledge transfer activities such as patenting, spin-off creation and consulting, has been widely debated, the influence of research on academic citizenship, i.e., on the service provided by faculty to their institution and to the wider collective, has remained surprisingly in the backward of the reflection on higher education systems. This study analyzes the effect of research performance on academic citizenship in a sample of 216 Italian academics in the field of management. With the exception of research awards and international scientific collaborations, research does not emerge to significantly impact upon academic citizenship, which may account for the scarce attention devoted to this latter. Since service is necessary for all organizations, universities included, to thrive, citizenship needs to be fostered and awarded through appropriate institutional and managerial policies that are here highlighted.

Keywords: Academic citizenship; Research excellence; Business school; Performance measurement; University; Higher education.

1. Not Only Researchers, but Also Citizens: A Theoretical Framework

Academics are increasingly experiencing the pressure to achieve outstanding research performance all over the world over the past decades (Pifer & Baker, 2013; Kok & McDonald, 2017). Academics have therefore been pursuing publications in A-ranked journals, a high number of citations, and a significant H-index (Agarwal et al., 2016). At the same time, although not so straightforwardly as for research, faculty are expected to perform a variety of additional knowledge transfer tasks, among which teaching, patenting, spin-off creation, dissemination, consulting services (Rossi & Rosli, 2015; Salter, Salandra, & Walker, 2017). Whether and how to reach a challenging balance between these heterogeneous academic duties has been largely debated in the literature, also tapping into possible trade-offs existing among them (e.g., Hattie & Marsh, 1996; Salter et al., 2017).

Faculty, however, are not only required to engage in knowledge transfer activities: they must also contribute to the ordinary functioning of their institution. This implies that they have to enact academic citizenship, which has been almost neglected in the reflection on higher education. The meaning of academic citizenship is far from being agreed on. While some studies liken academic citizenship to organizational citizenship behavior in general, i.e., to voluntary behaviors carried out for the sake of the organization without explicit reward expectations (e.g., Lawrence, Ott, & Bell, 2012), the still scant reflection on this topic questions its voluntary nature, while underlining its impact not only on the university, but also on the wider collective (Thompson, Constantineau, & Fallis, 2005; Macfarlane, 2011). Academic citizenship can in fact be defined as the service that academics provide to their employing organization—e.g., sitting on committees and Senate, directing programs, etc., to the scientific community to which they belong—e.g., acting as journal reviewer or editor, and the society in which they are embedded—e.g., representing the university on the media, participating in other institutions' boards. By embracing a view of academic citizenship that extends beyond the usual university boundaries, the relevance of higher education as core institutional player is revamped (Nørgård & Bengtsen, 2016). Accordingly, the university is no longer an 'ivory tower' that produces knowledge accessible and important only among scholars, but a 'placeful' institution able to share knowledge with a variety of other institutions and to affect societal policies (e.g., Nørgård & Bengtsen, 2016).

If the recognition of academic citizenship as a faculty obligation resonates with most faculty's experience, the comprehension of what factors foster or hamper its enactment, alongside its relationship with research excellence, still cry out for theoretical and empirical works. This study has the very goal of fleshing out the levers of academic citizenship and its interplay with research performance.

Individual and organizational characteristics likely affect faculty engagement in academic citizenship (Vogelgesang, Denson, & Jayakumar, 2010). Among individual features, former behavioral patterns influence the actual enactment of academic citizenship. Individuals in fact tend to stick to and reiterate behaviors in which they have achieved positive outcomes, since these latter are a source of self-enhancement and self-continuity, and for the same reason they tend to refrain from tasks and behaviors in which they have not exceled before (Carli, Tagliaventi, & Cutolo, 2018). Along this line of reasoning, research-focused effort, expressed through previous research performance, previous involvement in visiting scholarship, previous research awards, and previous network of international collaborations, reduces the willingness to undertake service as it is a diversion from consolidated courses of action. Conversely, experience with service tends to be repeated over time, as adequate expertise has already been developed. The following hypotheses can therefore be formulated:

Hypothesis 1a: Previous research-oriented behaviors are negatively related to successive academic citizenship.

Hypothesis 1b: Previous academic citizenship is positively related to successive academic citizenship.

Contextual factors can impact upon the performance of academic citizenship, too. A strong orientation to research both at the upper (university) and lower (department) levels implitly or explicitly communicates that academic citizenship is irrelevant, if not only detrimentals since it subtracts attention and time from research (Macfarlane, 2007, 2011). This relationship can be posited as follows:

Hypothesis 2a: Previous university orientation to research is negatively related to successive academic citizenship.

Hypothesis 2b: Previous departement orientation to research is negatively related to successive academic citizenship.

Another contextual factors that can influence the carrying out of academic citizenship is university size. The larger the university size in fact, the weaker the tie that links academics to its hosting institution (Macfarlane, 2007). In big organizations, the perception of the importance of one's own contribution to the overall success is lessened and individuals withdraw from behaviors that benefit the collective rather that themselves. Consequently, the relationship between university dimension and academic citizenship can be formulated as below:

Hypothesis 3: University size is negatively related to academic citizenship.

2. Data and Method

To test our hypotheses, we collected data on academics in Italy, where a higher education reform introduced a promotion system focused on research excellence in 2010 and connected university funding to research outputs. Our dataset is composed by 216 academics in management with different positions. We collected ther publications related to two different evaluation rounds, before the reform (2004-2010) and after (2011-2013) using Scopus database. We also collected their full CVs from the Italian accreditation database and from university websites. Academic citizenship activities were codified in three different variables, Institutional, Public and Discipline-based service, counting for each categories the number of engagements per year. The full list of variables is reported in Table 1.

Given that academic citizenship measures are overdispersed and not normally distributed count variables, Poisson and negative binomial models were compared in testing the effect of independent individual and contextual factors measured in 2004-2010 on the dependent variables of academic citizenship (Long, 1997). The likelihood ratio tests suggested that a negative binomial regression was preferable to a Poisson model. Robust estimators were used to control for mild violations of assumptions (Cameron & Trivedi, 2013).

3. Findings

Findigs are reported in Table 2, which presents the incidence rate ratios, indicating how many times the dependent variable would increase for a unit change in the independent variable.

Hp.1a was not strongly supported: the effect of past research excellence on the three forms of academic citizenship was not significant, but Research Grants had a significant effect only on public service (17%). Conversely, Hp1b found full support: the three forms of academic citizenship are influenced by previous experience of the same type. For instance, a previous commitment in public service increases the likelihood of engaging in academic service by 24%. Moreover, discipline-based service had a partially significant effect on institutional citizenship while past institutional service positively affected public service (4%).

Scarce support was found for Hp.2a showing that university ranking negatively influences only public service activities, while the effect on other types of academic citizenship is not significant. The negative effect of the quality of the department on academic citizenship (Hp. 2b) was not supported in our model. Similarly, Hp.3 on university size was not confirmed. The controls on academic role showed that assistant and associate professors are more dedicated to institutional service, respectively 159% and 135%, than full professors,

and assistant professors are more focused on discipline-based service than full professors (97%). Gender differences affected only public service with a stronger impact (101%) of being male.

4. Conclusion

Academic citizenship appears to be the missing kernel in the lively debate on higher education systems, which has extensively delved into the interplay between research and teaching and between research and teaching (Hattie & Marsh, 1996; Lawrence et al., 2012). Apart from the influence exerted by research awards and collaboration, this analysis does not disclose a relevant substitution or complementariety effect between research and service (Landry, Saïhi, Amara, & Ouimet, 2010).

The scant attention devoted to academic citizenship in higher education studies thus far can be traced back to the very lack of a clear relationship between this latter and the publishing effort that emerges from our analysis. Universities, like any other organizations, however, need citizenship behaviors to function effectively. It is high time that more empirical work and theoretical reflection address this topic, exploring further its relationship with a variety of knowledge transfer activities in different settings. Future studies could adopt both qualitative research based on interviews and surveys to shed light on the motivation underpinning faculty choices. In parallel, though, policy makers and university management should explicitly communicate the value of academic citizenship by including it in performance measurement systems (Vogelgesang et al., 2010). The perception that being good servants of an institution by providing service inside and outside its boundaries may not only be uninfluential, but even run counter individual assessment in career advancement has to be taken seriously into account and contrasted. Some scholars have in fact voiced the concern that playing out service be detrimental to academic careers, as it is deemed to be a sign of the incapacity to drive time and resources towards the gist of the academic profession, i.e., research (Thompson et al., 2005; Knights & Clarke, 2014). A revision of the actual appraisal system of faculty worth is evoked, and promoting studies on academic citizenship will reinforce this call, likely testifying to what most members of contemporary universities already know, i.e., that only hardly can each of us be excellent in all fields—be all in one—but a carefully designed diversification of excellence across individuals can render organizations excellent as a whole.

Table 1. Measures.

Variable	Description	Reference	Source
Previous high-quality research	Count of the scientific contributions reported in Scopus per year	Carli et al. (2018)	Scopus
Research awards	Binary variable coded as 1 if the scholar received a scientific award	Agarwal et al. (2016)	CVs
Previous Institutional service1	Count of activities and roles in university boards and committees per year	Macfarlane (2007, 2011)	CVs
Previous Public service1	Count of activities and roles in public bodies and non-profit organizations per year	Macfarlane (2007, 2011)	CVs
Previous Discipline-based service1	Count of peer reviewer or editorial board roles and scientific conference board membership per year	Macfarlane (2007, 2011)	CVs
International mobility	Binary variable coded as 1 if the academic did a visiting period	Jonkers and Cruz-Castro (2013)	CVs
International collaboration	Number of international co-authors of all the publications published	Carli et al. (2018)	CVs
University ranking	Universities' scores in the 2004-2010 Research Quality Assessment	Salter et al. (2017)	Reports[2]
Department ranking	Departments' scores in the 2004-2010 Research Quality Assessment	Salter et al. (2017)	Reports[2]
University dimension	Categorical variable for small (<10,000 students), medium (between 10,000 and 20,000 students) and big universities (>20,000 students)	Salter et al. (2017)	Reports[2]
Academic position	Binary variables for Assistant, Associate and Full Professor positions	Carli et al. (2018)	CVs
Gender	1 for males and 0 for females	Carli et al. (2018)	CVs

[1]: calculated for 2004-2010 period. The dependent variables are calculated for 2011-2013 period with the same procedure

[2]: Reports from the Italian National Agency for the Evaluation of the University and of Research System

Table 2. Negative binomial regression results for academic citizenship (Instutional, Public and Discipline-based service).

Variables	Institutional Service		Public Service		Discipline-based Service	
	IRR	Robust SE	IRR	Robust SE	IRR	Robust SE
Previous high-quality research	0.993	0.020	0.996	0.033	0.984	0.022
Research awards	0.952	0.041	1.171**	0.077	1.028	0.054
Previous Institutional service	1.113***	0.013	1.040**	0.019	0.997	0.014
Previous Public service	0.982	0.015	1.239***	0.037	0.958**	0.021
Previous Discipline-based service	1.024*	0.014	0.990	0.019	1.200***	0.029
International mobility	1.274	0.187	1.076	0.282	1.320	0.239
International collaboration	0.986	0.034	0.981	0.061	1.074*	0.042
University ranking	0.338	0.303	0.030 **	0.048	0.531	0.597
Department ranking	0.482	0.335	0.462	0.520	0.331	0.262
University dimension						
Medium (between 10.000 and 20.000 students)	1.340	0.276	0.559	0.224	1.019	0.265
Large (more than 10.000 students)	1.169	0.215	0.783	0.280	1.000	0.237
Academic position						
Assistant professor	2.590***	0.541	1.329	0.423	1.969***	0.507
Associate professor	2.349***	0.496	1.061	0.335	1.567	0.425
Gender (Male)	1.138	0.165	2.009***	0.480	1.154	0.206
Costant	1.051	0.349	1.329	0.779	1.156	0.459
ln(alpha)	-0.676	0.231	0.388	0.211	0.127	0.167
Observations	216		216		216	
Wald χ2	113.839		89.694		79.175	
Prob > χ2	0.000		0.000		0.000	
Log-likelihood	-470.326		-307.726		-447.876	
Cragg & Uhler's R2	0.413		0.353		0.310	

*** p<0.01. ** p<0.05. * p<0.1

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Indicators needed to design a student dashboard from lecturers' perspectives: a qualitative study

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Abstract

The number of students' enrolled in Higher Education online courses is increasing, and as a result, more data about their learning process is generated. The data produced can be displayed on a dashboard and help students in their learning process. However, lecturers' perspective should be taken into account to define the indicators of the dashboard as the design of the courses could impact on the elements included on it. And that is precisely the aim of this paper: to define the indicators needed to design a student dashboard in online courses taking into account lecturers' perspectives. This study was carried out with 10 lecturers from the Faculty of Humanities and Education from Mondragon Unibertsitatea. Online qualitative questionnaires were used to gather participants' perceptions. Results show that most of the lecturers participating in the research study identified four indicators to design a student dashboard: number of times students access the course forum, amount of contributions in the forum, number of times students consult the information booklet, and number of times each student has accessed the course in a week time. Conclusions drawn from this study highlight the importance of training lecturers and students on the pedagogical use of data visualization.

Keywords: learning analytics; dashboard; course design; lecturer; student learning process; self-regulation.

1. Introduction

The number students in online courses has increased in the last decade (Ipiña, Basagoiti, Jimenez & Arriaran, 2016). Therefore, data generated about their learning process in those technology enhanced learning spaces is also growing (Means, 2014). Learning Analytics (LA) arises with the aim of using student activity data in Learning Management Systems (LMS) to increase understanding of the learning experience and better support students (Dawson, Gasevic, Siemens, & Joksimovic, 2014). In fact, LA uses predictive modelling techniques based on the use of different algorithms to analyse students' digital traces in order to understand and optimize learning processes (Pardo, Jovanovic, Dawson, Gasevic, & Mirriahi, 2017).

LA research represents a broad array of methods that are used to derive support actions for students (Ferguson, 2012). Possible applications include: improving students' success (Arnold, Hall, Street, Lafayette, & Pistilli, 2012), better understanding the nature of social learning among university students (Buckingham Shum & Ferguson, 2012), improving learning design approaches (Mor, Ferguson, & Wasson, 2015), and guiding university education strategy (Rientes, Boroowa, Cross, Kubiak, Mayles & Murphy, 2016). The information derived from these applications are presented to lecturers or shown directly to students in the form of different dashboards (Verbert, Govaerts, Duval, Santos, Assche, Parra, et al., 2014), but most of the times with the purpose of supporting students' reflection on their learning process (Krumm, Waddington, Teasley & Lonn, 2014; Tanes, Arnold, King & Remnet, 2011).

However, more recent research in the area of LA attempts to understand students' reactions to the data visualized and presented in these dashboards. For example, Corrin and de Barba (2015) found that students were not able to interpret the information provided in the commonly used dashboards and, therefore, the effects on their learning were non-existent and sometimes even negative. Therefore, as some researchers pointed out (Gasevic, Dawson, & Siemens, 2015; Wise, 2014), there is a need to focus more on how to understand the meaning of the data provided by the dashboards, so that there is a positive influence on the learning scenario. Nonetheless, research conducted on the pedagogical use of data visualization and its impact on students learning process in scarce. And that is precisely the aim of the present paper: to analyze lecturers' perspective on the indicators needed to offer students a dashboard that could positively impact on their learning process.

2. Dashboard in LMS

Several terms are currently used as synonyms of "learning dashboards"; e.g., "educational dashboard", "dashboard for learning analytics", "data dashboard", and "web dashboard" (Schwendimann, Rodriguez-Triana, Vozniuk, Prieto, Shirvani Boroujeni, Holzer, Gillet &

Dillenbourg, 2016). Yoo, Lee, Jo & Park (2015) defined a learning dashboards as "a display which visualizes the results of educational data mining in a useful way" (p. 145), while Steiner, Kickmeier-Rust & Albert (2014) referred to it as "visualization of learning traces" (p. 9), Schwendimann et al. (2016) stated that a learning dashboard "is a single display that aggregates different indicators about learner(s), learning process(es) and/or learning context(s) into one or multiple visualizations" (p. 8). The use of different terms and definitions suggests that there is still no consensus on what constitutes a learning dashboard, and therefore, more studies are needed. However, the big challenge now is to make data from learning platforms processable by analyzing them and presenting them in such ways that are meaningful to different stakeholders (Sutherland, Eagle & Joubert, 2012).

While the popularity of learning dashboards has been increasing in recent years, the question of what 'correct' information is shown to different stakeholders and how this information should be presented remains largely unresolved. Few (2007) points out that, although visually appealing, many dashboards lack the ability to provide really useful information. Thus, so that dashboards become useful tools in students' learning process, the information should be displayed on dashboards one timely and accurate manner; i.e., should be coherent with the learning design (Baker, 2007).

3. Learning design

The learning design describes the sequence of learning tasks, resources, and supports that a lecturer builds for students during part or all of the academic semester (Goodyear, 2015). As such, learning designs provide a model of intentions in a particular learning context that can be used as a framework for the design of analytics to support university students in their learning and university lecturers in their teaching decisions (Lockyer, Heathcote & Dawson, 2013). Although this overcomes the difficulties of data accuracy, the challenge of learning analysis is to interpret the resulting data according to pedagogical intent and local context to assess the success or otherwise of a particular learning activity (Dawson, Bakharia, Lockyer & Heathcote, 2010).

Moreover, the interpretation of the visualizations also depends to a great extent on the understanding the context in which the data were collected and the objectives of the lecturer with respect to the interaction class (Leony, Pardo, de la Fuente Valentín, De Castro & Kloos, 2012). Therefore, interpretation of the analysis requires an alignment with the original teaching context to be useful as feedback on whether the learning design has achieved its purpose. Interpretation requires an understanding of the relationship between technology functionality, observed interaction behaviors, and educational theory (Heathcote, 2006). It is the conceptual bridge and understanding between the technical and educational context that remains problematic for learning analytics (Dawson, Heathcote & Poole, 2010).

4. Research

4.1. Aim

The objective of this paper is to define the indicators needed to design a student dashboard for online courses taking into account lecturers' perspectives.

4.2. Context and sample

The present study was carried out in Mondragon Unibertsitatea (MU henceforth). The study was conducted in the Faculty of Humanities and Education, where Primary Education Degree and Early-Years Education Degree are offered in the online modality. 10 lecturers involved in 10 different online courses participated in the study.

4.3. Instruments and procedure followed

Online qualitative questionnaires were used in this study. The open-question questionnaire was designed following the framework proposed by Pardo et al. (2017) and aimed at understanding the perceptions lecturers have about the most suitable indicators to be included in the student dashboard. All lecturers were given 5 days to fill in the questionnaire. A content analysis was conducted with the Atlas.ti software for qualitative analysis. Results obtained are depicted in the next section.

5. Results

All participants taking part in the study considered that using a dashboard to visualize students' progress and data could be important for students' learning process. In fact, 75% of the lecturers recognized that visualizing data is a key aspect to promote self-regulation and reflection about students' learning process. Moreover, participants of the research study asserted that data should be visualized at the beginning of the learning process as well as during and after the course. In the same line, all lecturers stated that they would be very interested in knowing how students use the educational resources offered in their courses. Furthermore, results indicated that data provided in the student dashboard may guide the redesign of the online courses included the resources offered in the platform. Nonetheless, 90% of the lecturers participating in the study state that training on the pedagogical use of data visualization is needed before using the student dashboard.

A summary of the indicators found is depicted in Table 1. Overall, four are the main indicators identified by the participants to design a student dashboard: number of times students access the course forum, amount of contributions in the forum, number of times students consult the information booklet, and number of times each student has accessed the course in a week time.

Table 1. Indicators chosen by the participants to design a student dashboard for online courses

Indicator	% of lecturers
No. of times students access the course forum	100%
Amount of contributions in the forum	100%
No. of times students consult the information booklet	80%
No. of times each student has accessed the course in a week time	60%
No. of tasks delivered out of date	40%
Satisfaction questionnaire filled in	20%
Information about the itinerary followed by the students (tracking)	20%

Source: The Author/s (2019).

6. Conclusions and further research

Results have shown that the participants of the study highly valued the importance of visualizing educational data to foster students' learning process in a meaningful way. Likewise, as Leony et al. (2012) and Pardo et al. (2017) claimed, visualizing data is perceived as very useful for student self-regulation and reflection within the learning context. Beside, our findings are aligned with the results found by Krum et al. (2014) and Tanes et al. (2011) as lecturers stated that they would be very interested in knowing how students use their course resources. Moreover, participants considered that these data could help in the redesign of their courses (Lockyer et al., 2013). Furthermore, 90% of the lecturers participating in the study state that training on the pedagogical use of data visualization is needed before using the student dashboard as stated by Schwendimann et al. (2016).

Lecturers considered that four indicators are most interesting to design a student dashboard: number of times students access the course forum, amount of contributions in the forum, number of times students consult the information booklet, and number of times each student has accessed the course in a week time. The indicators found could guide our next approach; however, future research should analyze the impact of using dashboard on students learning process. Nonetheless, students' perception towards the use of dashboards for educational purposes needs further studies. Moreover, further research is required to gain a deeper insight of the impact the online courses design can have on definition of indicators to design a student dashboard.

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Negotiated professional identities of academics in the context of structural reform and innovation at the university

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Abstract

This paper discusses the results of a qualitative narrative study that focuses on academics´ professional identity and teaching practice at the university during the structural reform at Tallinn University, Estonia. The aim of the research is to understand how professional identity is formed in relation to the development of teaching practice in the frame of interdisciplinary projects introduced as an innovation at the university. The central research question is: How do the continuously changing university context, suggested teaching approaches and innovative projects affect professional identity, beliefs and teaching practice of academics? The empirical data consists of 48 narrative interviews with academics from different study fields. The empirical data was analyzed using qualitative content analysis with narrative coding. On the individual level there are slow but meaningful changes in teaching practices, as well as beliefs, understandings and professional identities of academics.

Keywords: academics; professional identity; university; teaching practice; narrative study.

1. Introduction

This paper focuses on understanding how the identities of academics are negotiated in the context of structural changes at the university. Universities are undergoing contradictory changes, putting demands on the work of academics. Estonian universities, similarly to higher education institutions in Western Europe, North America and Australia have been led by neo-liberalization tendencies characterized by decrease in public funding and dependency on competence-based funding, introduction of new public management models, rise of audit culture and bureaucracy, ranking and metrics, merging of curricula and university units (Aavik, 2018). The academic staff are expected to fulfil multiple roles, including research and teaching, but increasingly also administrative and developmental tasks. We can argue that teaching practice and teaching excellence is not at the centre of emphasis in neo-liberal universities. On the other hand, there are multiple examples of outstanding universities where efforts have been made to develop teaching excellence and instructional approaches of university teachers or to introduce interdisciplinary learning initiatives that are expected to challenge previous learning and teaching practices and result in transformative change in teaching culture (Holley, 2009). However, adopting changes always involves re-construction of professional identities of academics. We will be exploring the interplay between professional identities and changes in teaching practice triggered by interdisciplinary learning introduced. The central research question in this paper is: How has the changing university context affected professional identity, beliefs and teaching practice of academics? We base our arguments on the analysis of narrative interviews conducted with academics from different study fields at Tallinn University

2. Professional identity of academics

In the frame of the constant changes in education the implementation research has been generally concerned that often the top-down initiated innovation effort has not involved widespread adoption (Cox, McIntosh, Reason, & Terenzini, 2011). Adapting to educational changes always means making sense of the changes (Spillane et al., 2002) and oneself in the changing work realities. Sense making is also strongly related to identity (re)-construction (Louis, 2010, p. 18). Existing research shows that universities are unique places of being and of engagement between human beings, also universities are places of complexity-in-being (Barnett, 2003, p. 179). University academics and how they construct and reconstruct their professional identities have been actively studied by many scholars (Barnett, 2005, Clegg, 2005, Harris, 2005, LaPointe ,2009), but the concept of professional identity has been defined differently (Beijaard, Meijer & Verloop, 2004, p. 122).

Identity is a socio-cultural category by means of which we present and locate ourselves socially (Noy 2004, 116). Professional identity is considered to be a personal and cognitive

construct (Benwell & Stokoe 2006), subjective phenomenon, which consists of values, beliefs and experiences (LaPointe 2009, 1); it is a part of the self-concept related to the profession individuals develop (Sancha & Molinero 2016). Inspired by the constructionist view on career identity, Kirsi LaPointe argues that professional identity is a practice of articulating and performing identity positions in narrating experiences (LaPointe, 2009, 2). We draw on the idea of professional identity as not a fixed phenomenon, but rather relational to others and the context. Most of the authors treat identity development as an ongoing process of interpreting oneself as a certain kind of person and being recognized as such in a given context (Beijaard, Meijer & Verloop, 2004, p. 108). Universities and academic life are becoming more and more complex and differentiated spaces, which influence professional practice and identity of academics. Scholars have argued that traditional academics identities based on collegiality and on autonomy are under threat (Clegg, 2005, 332). However, identity construction is a complex and contextual process of continuous re-interpretation of one's previous experience in relation to peers, therefore different identity profiles could be expected to exist among professionals (Canrinus et al., 2011).

3. Study context

Interdisciplinary learning introduced as an educational innovation at Tallinn University provides a unique context for our study. Since 2016 interdisciplinary projects *LIFE - Learning in Interdisciplinary Focused Environment -* targeted at solving real-life problems have been integrated as compulsory courses into bachelor and master level curricula at Tallinn University. *LIFE* projects are aimed to differ from general courses as here the active role of the students in setting the aims and scope of the learning has been emphasized and the role of the supervisors is rather to support the group processes. (Erialasid Lõimiv Uuendus (ELU) kontseptsioon, 2018). The interdisciplinary project courses mostly carry the philosophy of student- or learning-centered pedagogical approaches such as „collaborative learning", „problem-based learning" or „active learning. The study was conducted by an interdisciplinary team of researchers from four disciplines during 2016–2018.

4. Research design

Empirical data was collected using a narrative interview design (Rossiter, 1999). As a method, narrative interview is based on a generative question and focuses on experiences as expressed in lived and told stories of individuals (Creswell, 2013, p. 54). When carrying out narrative interviews, we applied the unstructured approach and focused on academics' stories about their professional identity and teaching practice. The interview started with a generative question "Please tell how you became a university teacher, tell everything that is important for you in teaching". In the last stage of the interview eight thematic questions

were asked. After the narrative interview, examples of innovative teaching and *LIFE* supervision practices were asked for. All interviews took place at the university in a venue familiar to participants. Interviews (duration ranging from 1,5 to 2 hours) were recorded, transcribed, coded and analysed by four researchers.

Data collection took place in two stages. *The sample* of our research was created by combining stratified random (Bryman, 2008, p. 190) and criterion-based sampling (Patton, 2002). In the first stage, separate lists of randomly selected academics from five institutes were created. In the second stage, final sample was created of those academics who had been active in supervising LIFE projects. Narrative interviews were conducted with 48 academics, aged from 29 – 60 years, 11 were male and 37 female; the teaching experience ranged from two to 30 years.

In the data analysis we employed the qualitative content thematic analysis method (Elo & Kyngäs, 2007) with narrative coding (Saldana, 2009, p. 46). Clandinin and Connelly (2001) refer to the stories as "field texts". Frank points out that people tell stories, but narratives come from the analysis of stories (Frank, 2000, cited Realay & Have, 2005, p. 227) Analysis process started with reading and re-reading interviews and included next steps: 1) identification of the empirical materials for analysis; 2) preparation of the materials for inductive analysis; 3) open holistic coding, searching for themes and categorization; 4) narrative coding (Saldana, 2009, p. 46). The purpose of narrative coding was to reconstruct different stories into central narratives (Flyvbjerg, 2016). Three types of narratives were constructed*: LIFE* narratives, Professional Identity narratives, and Teaching Practice narratives. The data was analysed and triangulated by four researchers.

5. Findings: Identities in the narrative

Below we present the summary of the findings from the first stage of the ongoing project. The findings indicate similarities to the previous studies on the professional identity of academics arguing that the university context and personal factors play important role in the formation of identity (Lankveld et al., 2017, Trautwein, 2018, Trede, 2012). Professional identities are closely shaped by personal and contextual factors - personal life events and choices, professional experience, and teaching practice at the university. Our findings showed that professional identity of academics is interpersonal and related to previous personal, professional and meaningful experiences and the self-concept.

Firstly, identity developing means creation of self-consciousness. "Entering" the university and turning points are meaningful experiences for academics and also as intrinsic components for constructing professional identities.

Secondly, professional identity is related to values and beliefs. The changes at the university have not only influenced values, but made the values even stronger.

Thirdly, the complexity of professional activities and roles of academics have led to the lasting internal identity conflicts, which are visible due to: a) role conflicts and need to perform different and often contradictory roles; b) hybrid identity (combination of different types of identities) or rule bound/regulations of the university; c) the time limit for reflecting on one's own teaching practice; d) myriad of teaching tasks.

Fourth, teaching practice has been experienced differently by academics. It was regarded as an isolated practice; activity or approach; experimentation; communication with the students; students' learning and their responsibility; developing a relationship with the students; collaborative teaching practice with high expectations in relation to students; collaboration with the students and colleagues; as a personal and emotional experience.

*B*ased on the analysis we have identified different professional identity profiles among the academics: academics as *autonomous creators*, *active followers of change, upholders of traditional teaching/learning culture.* All of them have different sense of self-concept, professional identity and different degree of agency to influence teaching practice and learning culture at the university.

We present an example from Paul´s story, a story of an "*autonomous creator"*. Due to the complexity of the analysed empirical data, we selected and present the meaningful narrative from his story which mirrors personal meanings of being an academic, supervisor of LIFE projects and a strong sense of professional identity in relation to the teaching practice at the university. **Paul**, (Ph.D) is 44 years old and works as a senior researcher. His work task include teaching, supervision of students and supervision of LIFE projects. He has 13 years of teaching experience at the university and has supervised three LIFE projects and is currently supervising two projects. The beginning of his story is related to his previous experience as a school teacher and is closely connected to his personal life. To illustrate how Paul´s professional identities are formed and co-constructed, we will present below the narrative, which has been constructed by using quotes from his interview**.** His professional identity is distinctive and not typical, related to strong self-positioning, values and previous experience. The changes at the university have not only influenced his values, but made his values stronger. We title this narrative as Paul´s ***MISSION NARRATIVE***

It is a long story. I came to the university in 1994 to study teachers´ profession as I had already worked one year as a teacher. My work experience as a university teacher is a short one. Perhaps it is good that I don´t have any fixed frame how one should teach. I tend to explore many things on my own. What matters is what we want to achieve, what is the aim, what is the aim of the education. Education is the only way we can affect considerably the environmental behavior, behavior of people. As part of the restructuring at the university the

change was looked forward to. For me it is important that the LIFE projects would succeed as this could bring a qualitative change what happens at the university. I see LIFE as an opener that teaching methods and learning approaches could change at the university. LIFE is a practice demonstrating that by implementing a project you can learn something way more intensively, entirely differently. For me LIFE is a step towards that direction. That there could be an interdisciplinary project implemented by students.

6. Closing remarks

Changes require not only creating and developing innovations for supporting students' learning, redesigning teaching and learning processes and approaches, but also adopting innovative strategic approaches for supporting academics and their professional development and identity (Gibbs 2005). Overall we conclude that professional identity development is a significant and meaningful process for academics because it is one of the main resources for adaptation to the developments and broad changes.

Acknowledgement

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Disruptive Technologies supporting Agricultural Education

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Abstract

This paper looks at a number of different technologies that are being used currently in agricultural education at The University of Queensland (UQ), Australia through the lens of 'disruption' as a positive force. The paper describes a number of tools and systems that have been developed, tested and implemented to engage students and provide an interesting, educative interactive experience at UQ. These tools include Internet of Things (IoT) multisensory mesh networks and associated data dashboard developments for biophysical monitoring, drone technology design and build for agricultural management, and augmented reality simulations as blended learning experiences. These tools have been used in teaching in 2017, 2018 and 2019 and have been evaluated positively for student engagement and the learning value to students of the tools.

Keywords: Internet of Things; drones; data dashboards; augmented reality

1. Introduction

Young people are difficult to encourage into agriculture and related educational areas, because the industry sector is perceived as labour intensive, non-academic and lowly paid. This is frustrating to the agrifood industry generally, and also to educators in the sector. A potential solution is to use digital technologies as a means of innovating legacy systems in the sector and to use these same digital technologies as a 'disruptive agent' to change the way agricultural education is undertaken and increase student engagement.

1.1. Technology as a 'disruptive' agent

A disruptive innovation or technology is one that can 'disrupt' or 'overturn' traditional business methods and practices and which in the long term, can leads to the creation of new 'ground-breaking' products (Christensen & Overdorf, (2000); Millar, et al. (2018).

Over the last decade, disruptive technologies in the form of the Internet, mobile computing (including social media for marketing purposes), Internet of Things (IoT) technologies to collect and transmit real time data, the use of cloud computing to facilitate the analysis of such generated big data and robotics to make use of the data, have been identified as having impacted the agrifood industry in an unprecedented way to create and capture value across the whole chain (Bryceson, 2006; Lehmann, et al. 2012; Bryceson & Yaseen, 2018).

ICT technology as a disruptive agent in education, particularly in higher education, has been much discussed starting in the late 1990s with the advent of the internet and then onwards with the number of articles discussing different aspects of 'disruptive' technologies increasing significantly. For example Archer et al. in 1999 identified that the internet was likely to be a disruptive technology in higher education generally with learning materials delivered 'online' via the internet; Sharples (2003) talked about using mobile phones as tools for learning; Garrison & Kannuka (2004) discussed the notion of blended learning as "[combining] *text-based asynchronous Internet technology with face-to-face learning*"; and Flavin (2012), indicated how Google and Wikipedia were being used for educational purposes. By 2017, the world of disruptive technologies used in education had developed further with Sagenmüller (2017) predicting that Virtual Reality (VR) e.g. VRChat; collaborative platforms such as Google docs; Augmented Reality (AR) e.g. Microsoft Hololens; and Artificial Intelligence (AI) were the next innovations that would 'revolutionise' learning.

In this paper we look at how it is possible to create engagement and more realistic learning opportunities in agriculture for young people using a combination of disruptive educational technologies – Internet of Things and associated data dashboards, drone design and build and 3D holographic augmented reality (AR) assets - along with a tried and tested educational approach of 'Active' Problem Based Learning (PBL) (Schmidt 1983, Wood 2003).

2. Disruptive Agricultural Education tools

2.1. Internet of Things (IoT) and Data Dashboards

With the current popularity of Internet of Things (IoT) technology, much research is ongoing in the use of wireless sensor networks in agricultural research studies, (Stoce et al. 2016).

In 2016, Bryceson et al. (2016a) described the development of an IoT multisensory mesh network on The University of Queensland's 1100ha rural campus in SE Queensland, which was set up for agricultural and environmental biophysical data collection in the managed landscape, primarily for educational purposes. A multifaceted web-based interface to the real time streaming IoT data, and problem based learning modules using the data (Figure 1) have also been developed to produce more engaging and active learning based teaching tools.
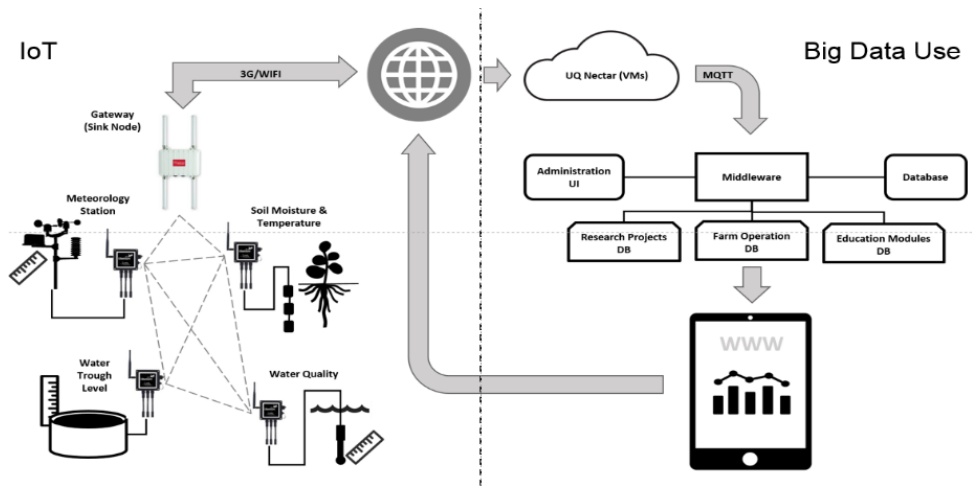
Figure 1. UQGatton IoT multisensory mesh network development and big data use in 2017

The existing applications include a generic data dashboard app to visualise sensor data in real-time via charts and a mapping tool, and a number of other elearning applications which can provide course focused visualisations and assessments. As part of the dashboard app, users have the option of downloading raw sensor data (e.g. in CSV format) for use with external applications such as Excel or the statistics package 'R'. Further development in 2018 has included a Dairy Dashboard app where management data from the UQ Dairy has been included to enable managers and students to visualize the dairy data to ensure that the dairy is performing appropriately against industry benchmarks.

2.2. Drone Design & Build

The use of satellite data or airborne data has been used in agriculture for many years (Kauth & Thomas, 1976). This type of data has primarily been seen as a useful way of collecting

spatial variability information covering many hundreds of hectares at a time in order to manage crops, pests, livestock and water more efficiently (Houston & Hall, 1984; McVicar & Jupp, 1998). Unfortunately the cost of acquisition and processing of this type of remotely sensed data has proven prohibitive to most agricultural managers in the past who have also had the difficulty of finding adequately trained staff.

However, in the last 5 years much satellite data can now be obtained free through NASA https://earthdata.nasa.gov/ although the issue of resolution and useful (for agriculture) revisit frequency remains. During the same timeframe, there has been an exponential growth in the miniaturisation of electronic componentry which has driven the development and use of small drones (Wang & Tian, 2011). These drones have been mainly multirotor or fixed wing machines, flying with sensor payloads that can obtain low cost imagery at useful revisit frequencies (Anderson, 2014). Such data can then be processed with readily available software on current hardware. Availability of skilled personnel to do the work is still an issue.

At UQ this lack of skilled personnel is being addressed through the establishment of an Agricultural Remote Sensing Lab, and the development of a third year course in Precision Agriculture. Undergraduate students taking the course, or who are doing an internship or summer research project, as well as postgraduate research students, are all able to make use of the Lab to actively learn to both design and build drones.

In design and build projects students engage in what is regarded as an active learning process (Prince, 2004) - often called 'learn by doing' (Harvard, 2014) - which takes place in the Laboratory and/or field. The learning process is then brought to a close with the creation of a small report outlining the project specifications, the design and build process undertaken, and the implementation of the drone in a real life project, making explicit the internalized knowledge obtained through the process (Smith, 2001).

A number of these drone design and build projects and resultant student engagement, are described in Bryceson et al. (2016b). The UQMiniAg drone (Figure 2) is the most recent addition to the UQGatton drone 'fleet' and has been designed as an aggregate from the collective experience on drone development from research applications. It balances the capabilities of bigger drones, autonomous mission planning and camera payload, but comes with the 'comfort' of a smaller size.

Figure 2. UQMiniAg Drone

The size and weight of the drone (<1.3kg) allows multiple units to be deployed in a dedicated carrying case, simplifying the use of the drones for practical labs performed under field conditions. In addition, the machine size reduces the risk of any injury should students lose control of it, by using lower torque engines. With the standard virtual fence and return to launch safety features, the unit can also be adjusted to 'tame' its acceleration curve and limit its operational range effectively reducing risk associated with its kinetic and potential energy.

The UQMiniAg Drone was developed to work in conjunction with a Raspberry Pi NoIR filter camera that enables imagery in three bands: red, near infra red (NIR) and blue, to be captured. This imagery enables basic remote sensing training to be undertaken by introducing students to the use of reflected light from the earth's surface as a proxy for vegetation stress or vigor. The Normalized Vegetation Index (NDVI) (Tucker, 1979), is taught using imagery taken from a drone mission flown by the student. NDVI gives an index of vegetation greenness or health using the red and NIR wavelengths which can be converted to a stocking rate appropriate for a paddock based on vegetation health. (Figure. 3 below).
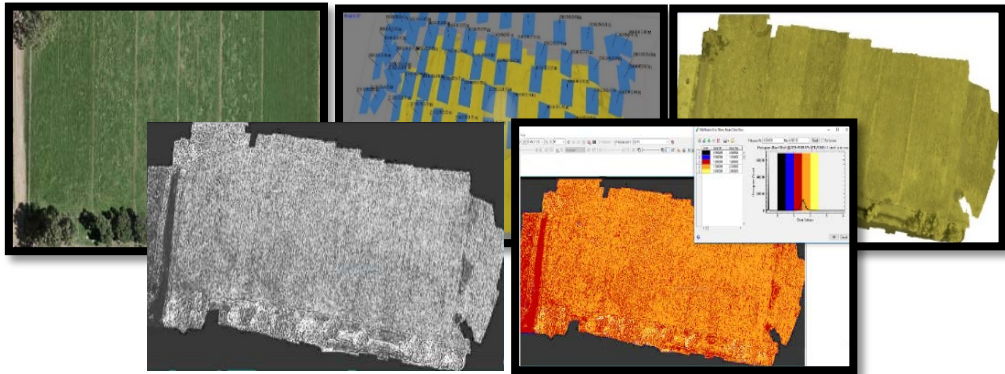
Figure 3. (i) Red Green Blue (RGB) Image captured using drone and NoIR camera, (ii) Multiple images mosaicked to form a single large image, (iii) Raw NoIR camerdata, (iv) Raw NoIR data processed for NDVI (light pixels maximal vegetation) and (v) Stocking rate capacity (1-2 animals/ha) mapped for paddock.

This type of active learning in multidisciplinary domains empowers the student to not only learn how to use the future tools of their trade, but it also teaches this within context of management decision making on farm, avoiding the all too common complaint by students of "*Why I am doing this?*". In Semester 1, 2018 (Feb-June), 42 students participated in the Precision Agriculture course – all flew one of the drones and processed the data as explained. Very strong positive responses to the 'Drone Assignment' were expressed despite it being a technically challenging piece of assessment.

2.3. Augmented Reality(AR)

Schueffel (2017) defines AR as being "*a direct or indirect live view of a physical, real-world environment whose elements are 'augmented' by computer-generated perceptual information, ideally across multiple sensory modalities, including visual, auditory haptic (touch), somatosensory (sensation), and olfactory (smell)" (Schueffel, 2017,* p. 2*).*

AR in education is still new and relatively untested. Bryceson et al. (2018) provide a comprehensive review of AR in education to date with published research indicating that AR accelerates engagement with students and engagement of students with the content particularly when theoretical knowledge is not enough to obtain proper skills in professional areas.

A pilot project was undertaken in 2018 to develop a PBL based AR Application (Affluent Effluent) to investigate the feasibility of using Microsoft Hololens technology for teaching in the environmental and agricultural space. The aim for the project was to test student engagement with the technology and appropriate subject matter (in this case waste water management), through using Microsoft's augmented reality technology, the Hololens (https://www.microsoft.com/en-au/hololens), and to also test the use of technology and model/simulation for learning about the issue.

The AR app development process is documented in Bryceson et al. (2018) but from a teaching perspective, the AR asset had to have appropriate visualisations to create an interesting learning environment both above and below water. From a learning perspective, the AR simulation needed to let students achieve the learning objectives of the simulation, by linking to an assignment associated with the content. The assignment could then enable a judgement to be made around the student's ability to identify the problems from the simulation**,** understand the broader issues relating to these problems, and be able to make recommendations for fixing the problem. A 100% response rate for an informal evaluation of the Pilot (n = 11) for "Strongly Like" to all 5 questions relating to the AR tool's engagement and interest questions, was received when the Pilot App was run with a group of students. Further refinements of the AR app have taken place in 2018 with formal evaluations undertaken in early 2019 which will be discussed at oral presentation.

3. Conclusions

All three projects developed and used disruptive technologies for agricultural teaching. They have all proven to engage students with the technology, and with subject matter. They have all taken considerable resources (both human and financial) to achieve, which needs to be further investigated on a cost/benefit basis for any scaling up. A further finding from all the projects is that there is a need for professional development of lecturers and facilitators in

designing the way such technologies can be used in a class and how appropriate assessments can be developed, which are important in contributing or otherwise, to their success.

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Becoming College and Career Ready: Combating The New Digital Divide – A Literature Review

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Abstract

The availability of technologies for supporting personal, productivity, communications, and business tasks is ubiquitous and expected. Educational systems have a significant responsibility to ensure future generations are skilled to assume job duties involving the pervasive use of digital assets. Schools and higher education institutions, being at the epicenter of preparing the workforce for the adoption of technologies for learning and productivity, are increasingly making significant investments to develop digital skills among students. Given the increased adoption of technologies for instruction in U.S. classrooms, the digital divide as a concept may be shifting from lack of access, to a deeper context referred to understanding how to purposefully utilize technology to develop literacy, support academic growth, conduct research, and enhance productivity. There is evidence of significant skill gaps between students coming from high versus low socio-economic households, therefore, it is imperative to prioritize investments in technologies for learning and robust digital pedagogy practices in schools serving low socio-economic status students. This paper provides an updated definition of the digital divide and the importance of providing effective technology-based pedagogy to students from poverty to prevent skill gaps from becoming a competitive disadvantage as they strive to be successful in college and careers.

Keywords: digital divide; digital learning; technology skills.

1. Introduction

The conceptualization of the digital divide based on lack of access to technology assets is a definition that has historically caused confusion (Gunkel, 2003). Dijk (2006) argued that the generally accepted definition of the digital divide as an access issue is laden with assumptions, including, the existence of a defined gap between two groups, the haves and the have-nots, the suggestion that the existing gap is difficult to close, the affirmation that the inequalities are between included and excluded individuals, and finally, that the digital divide itself is static in nature. Gunkel (2003) and Dijk (2006), both argued that it is often mistakenly suggested that access to technology largely narrows the digital divide while being beneficial for the economy. Assumptions and misconceptions notwithstanding, the term digital divide is still relevant for discussion, analysis and research. Gunkel (2003) stated that the term digital divide carries several meanings with important implications including the modes of divide: divide based on access to technology, and divide based on the skillfull use of technology. The new digital divide is decreasingly based on access and increasingly based on expertise in the utilization of devices: the gap in ability to utilize technology for learning, productivity and research purposes. To be clear, the access-based divide is not entirely a concept of the past; according to Rowsell, Morrell, and Alvermann (2017) people living in poverty still do not generally own technologies commonly available to more affluent families, thus creating a cycle of usability deficit gaps: the less low socio-economic populations have access to digital resources, the more difficulty they have achieving the same level of prowess in technology use demonstrated by more affluent families (Rowsell, Morrell, & Alvermann, 2017). Jones (2013) described this phenomenon as normalized class-privilege. Even though technology onwership statistics are somewhat promising, as evidence by the three quarters of children in the United States with home access to cell phones (Rowsell, Morrell, & Alvermann, 2017), the upward trend in access does not automatically equate to increased skills in the use of technology for productivity or learning. Students from low socioeconomic households as well as those living in rural settings, demonstrated lower levels of skills, utilization and access to technologies than students living in more affluent areas (Thomas, 2008). Kantabutra and Tang (2006) argued that rural students demonstrated decreased levels of academic performance due to differences in access, experience and use of technology in schools, while Rossing, Miller, Cecil and Stamper (2012) argued that students from lower socio-economic households had more than 50% less experience with computers and mobile devices than affluent children in the same age group. Furthemore, Dijk (2006) argued that even if the gap of access to technology in the developed world seems to be closing, the gap in skills in the use of digital applications continues to widen. The implications of these trends should not be underestimated; the 21st century workforce must be equipped with specific hard skills, as well as soft skills, in order to competitively join a highly dynamic job market (Park Woolf,

2010). Redefining the instructional experiences students learn through is essential to truly prepare the next generation of productive and highly adaptable workers; the shift will be crucial if current generations are to achieve readiness for a highly competitive real-world demanding the mastery of an updated set of skills (Park Woolf, 2010).

2. Methods

This systematic literature review was conducted utilizing the EBSCOhost, JSTOR, and LexisNexis databases. Articles published between January 1st, 2002 and November 30th 2018 were considered for review based on the following criteria:

- Search terms: digital divide, and, technology and inequalities.
- Relevancy of topic: confronting the digital divide, one-to-one computing in low-income schools, decreasing technology inequalities for college readiness, skills based digital divide, and technology integration and poverty.
- Qualitative and quantitative peer reviewed studies.
- Analzyed publications were not limited geographically, however, U.S. based research comprised the primary source of information.

Additionally, the following definitions were essential for the development of this review:

- **Digital divide:** gap in physical access to computers, and computers, the internet and mobile devices as technologies evolved (Deursen & Dijk, 2010).
- **Digital learning:** high-quality instructional practice effectively utilizing technology to strengthen learning experiences while ensuring students reach their full potential (Alliance for Excellent Education, 2018).
- **Technology skills:** skills and competencies, beyond basic proficiency, allowing individuals to accomplish tasks in technology-rich environments (OECD, 2010a)

Information was obtained legally and cited following strict adherence to APA referencing format.

3. Discussion – Conceptualizing the New Digital Divide

The origins of research on the digital divide are based on statistics measuring population percentages lacking access to computers and network connections for a variety of purposes, including the ability to acquire information beyond physical reach. Unfortunately, *access* is still the most pervasive concept referred to when discussing the digital divide, mainly because access to devices, broadband networks and other technologies have driven the conceptualization of the argument for a long period of time (Dijk, 2006). However, according to Gunkel (2003) utilization, skills and abilities should be crucial elements

surrounding discussions related to the digital divide, in particular when planning for technology-driven educational initiatives. KewalRamani et al. (2018) stated that U.S. students without access to the internet at home demonstrated lower levels of achievement in core subjects across national and international assessments. Camerini, Schulz and Jeannet (2017) argued that recent studies in Europe defined the digital divide in practical terms: children from parents with higher educational levels are more skilled at utilizing devices for informational needs. In a British study by Peters, Seeds, Goldstein and Coleman (2007), 92% of students reported having a computer with internet connectivity at home, however, access to the technology by social class differed from 97% of students (class AB) versus 69% of students (class E) (Figure 1) (Ferrer, Belvís & Pàmies, 2011).
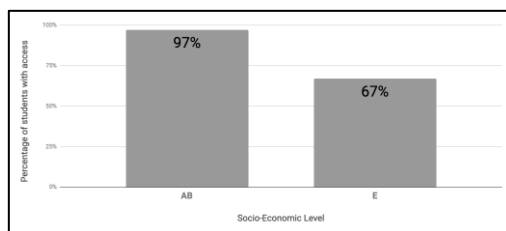
Figure 1. Internet connected device at home (adapted from "Tablet PCs, Academic Results and Educational Inequalities," by Ferrer, Belvís and Pàmies, 2011)

In the United States, students living below the poverty line between the ages of 5 and 17, have lower rates of home internet access than students living between 100% and 185% of the poverty threshold (KewalRamani et al., 2018). There is also evidence of a gap in access based on race: American Indian/Alaska Native, Black, and Hispanic students have lower rates of internet home connectivity than their White, Asian, and of Two or More Races peers (KewalRamani et al., 2018). Additionally, despite the pervasive access to broadband internet connections in most American public-school classrooms, the digital divide based on instructional opportunities in low versus high socio-economic status schools remains a reality (Thieman & Cevallos, 2017). Societal issues at the root of inequalities, including, professional status, ownership of assets, professional networks and access to power structures, may still be relevant when researching the cause of technology skill gaps. Unfortunately, a significant shortcoming of the digital divide research is the exclusion of the causes of inequalities in studies addressing technology skill gaps of low socio-economic populations (Dijk, 2006). Governments and planners in developing countries are increasingly wary and even alarmed at the width of the digital divide evidenced in low-income populations: individuals who are being left behind due to low levels of access to technology, compounded by being left further behind by their more well-off fellow citizens due the disparate quality of their respective educational opportunities (Forestier, Grace &

Kenny, 2002). Plans can, and should be adopted, to challenge the notion of digital fault lines by ensuring all students, affluent and from poverty alike, have access to high quality learning through digital devices (Rowsell, Morrell, and Alvermann, 2017). There are encouraging signs that the concept of equity of access is taking hold in school systems across the United States. Keane and Keane (2017), argued that the availability of devices in classrooms based on 1:1 ratios is trending higher, while Zucker and Hug (2008) stated that the technology access barrier is vanishing: the number of American schools providing thousands of students with digital devices for instructional purposes continues to grow. Thomas and Lewis (2010) stated that as of 2008, 100% of U.S. public schools had at least one instructional computer with internet access while 58% of campuses owned laptop carts. Investing in learning technologies for integrating devices into instruction supports the commonly held belief that digital assets are beneficial for academic and career readiness (Lewis, 2016). However, merely providing devices is not enough; a fully developed strategic planning process for the integration of technology, executed with fidelity, is essential to achieve positive academic results (Williams & Larwin, 2016). It is important to leverage digital tools in classrooms through robust pedagogy practices to effectively engage students on the reflective analysis of information, the creation of new knowledge and the distribution of digital content (Rowsell, Morrell, & Alvermann, 2017). In order for these changes to take place, leading a paradigm shift requiring profound transformations in pedagogy practices, from teaching with technology, to intentionally guiding students to create and design through digital devices is necessary (Tan, Kim, & Yeo, 2009). The development of writing skills in the digital age provides an excellent example; Jesson, Mcnaughton, Rosedale, Zhu and Cockle (2018) reported that writing instruction can change in classrooms with access to technology assets; a more comprehensive definition of writing in the digital classroom includes the use of images, sounds, and graphics, to support traditional written communication. The effective integration of learning technologies can also help to differentiate learning (Harris, Al-Bataineh, & Al-Bataineh, 2016) and enhance digital collaborative interactions among students (Soffer & Yaron, 2017).

4. Current Challenges and Further Implications

Cotten, Hale, Moroney, O'Neal and Borch (2011) argued that even though school systems across the United States are increasingly integrating technologies for learning, the lack of available data explaining the factors that determine the successful implementation of digital devices in classrooms is an issue. Understanding the local context, and more importantly, educators' needs, is crucial (Pruet, Ang and Farzin, 2016). Teachers are ultimately the ones driving the technology integration in classrooms, thus it is crucial to understand how and why educators accept to utilize mobile learning technologies as part of their instructional tool-kit (Ifenthaler & Schweinbenz, 2013). The deployment of learning technologies

requires specific strategies to address both, the digital integration skills of the teaching workforce, as well as systemic changes to support the success of the initiative (Stanhope, and Corn, 2014). Providing effective training and implementing organizational shifts to support the utilization of learning technologies in classrooms is, therefore, necessary; Keengwe, Schnellert and Mills (2011) argued that effectively integrating digital resources in classrooms is essential, if not critical, if schools are focused on engaging students effectively in the digital age while contributing to their college and career readiness status.

5. Conclusion

Beyond a definition based on access to technology assets, a more robust conceptualization of the digital divide has grown to include elements related to skills, competencies and abilities to utilize digital applications for learning, research, productivity and other meaningful purposes. Strategically planning to confront the digital divide in academic settings is an important aspect of educating the next generation of productive citizens. The importance of investing in digital assets for implementing effective learning experiences should not be underestimated; on the contrary, it should be considered essential and beneficial for student readiness. Even though providing access to learning technologies is an important first step, access by itself does not guarantee successful academic outcomes, or the narrowing of the digital divide. Strategies for the effective implementation of technologies for learning must include the planning of robust instructional application of the devices. The digital divide can be conceptualized as the absence of meaningful opportunities for students to be producers of information, as opposed to merely consumers of content, and to utilize technologies for learning, thus helping to narrow technology skill gaps based on income, access and opportunities. Ultimately, having the skills to utilize technology effectively to be productive and solve problems has been found to be increasingly important for the economic and social wellbeing of individuals (OECD 2016a). Providing meaningful digital learning opportunities to student populations is, therefore, not only our professional duty, but more importantly, a moral imperative.

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Evaluating the bones of adaptive learning: Do the initial promises really increase student engagement and flexible learning within first year anatomy subjects?

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Abstract

Knowledge of human anatomy is essential in first-year undergraduate allied health courses. Traditionally this discipline has used time and resource intensive laboratory classes, however recent changes in resourcing and student learning preferences have led to a combination of pedagogical approaches being used. The aim of this study was to examine whether the use of Smart Sparrow adaptive and interactive online resources provided real flexibility in learning and influenced both student engagement and motivation to learn for allied health students studying first year anatomy. Twenty adaptive online anatomy lessons were created. These adaptive lessons were evaluated with (i) a student survey and (ii) inbuilt learning analytics (n = 157). Our results showed that a total of 96% of students agreed or strongly agreed that the resources enhanced overall engagement in the subject and 96% found the resource easy to access. Overall our findings revealed that students overwhelmingly engaged with the lessons, and self-reported improvements in their learning through repeated use of flexible and adaptive learning resources.

Keywords: Adaptive learning; flexible learning; assessment; allied health education; anatomy education.

1. Introduction

Success in human functional anatomy is essential for students enrolled in allied health courses with failure often resulting in slower course progression and/or course attrition (Kruzicevic et al., 2012). Anatomy subjects at Charles Sturt University (CSU) are service taught, content heavy and often challenging for students. Some students bring prior learning to the classroom whereas others have no knowledge of anatomy whatsoever, resulting in diverse student cohorts. This combined with various student learning styles presents ongoing learning and teaching challenges for the academic particularly as disengagement is common when the content is perceived as "just too difficult". Traditionally, anatomy has been taught using conventional strategies including lectures, tutorials and laboratory classes. However, computer based learning resources have become commonplace in the curriculum particularly for medical students (Green et al., 2018) as evidence suggests that the best way to teach anatomy is with a combination of pedagogical strategies (Estai & Bunt, 2016).

Contemporary online, adaptive learning experiences that are designed for high engagement, yet are flexible to the needs of learners, present a unique way to address challenges in teaching large, diverse student cohorts. These interactive learning resources provide flexible learning opportunities for students where two key factors, pace of learning and flexibility, are under their control (De Boer & Collis, 2005). Adaptive learning adjusts the level of instruction in response to individual student responses to assist in personalisation of instruction and provides deep and rich learning experiences (Adams Becker et al, 2018). One example of an adaptive learning design platform is Smart Sparrow which has been successfully implemented into a range of undergraduate disciplines (Polly et al., 2014; Makransky et al., 2016; Wong et al., 2015). Success with adaptive learning technologies has also been reported in medical courses (Green et al., 2018), however there is little published data evaluating adaptive learning resources for mixed student cohorts in any discipline, including anatomy.

The overall objective of this study was to analyse students' perceptions of learning from a series of online adaptive anatomy lessons. In particular, we examined whether the adaptive lessons provided a flexible learning environment and influenced student engagement and learning within a diverse cohort of first year allied health students studying anatomy.

2. Lesson Design

2.1. Participants

One hundred and fifty seven first-year allied health undergraduate students enrolled in an introductory human anatomy subject in 2016 and 2017 participated in the evaluation of the

adaptive lessons. The students were enrolled in the Bachelor of Podiatric Medicine, Bachelor

of Occupational Therapy, Bachelor of Physiotherapy or the Bachelor of Health and Rehabilitation Science. Ethics approval for this study was received from the CSU Research Ethics Committee (HREC Protocol No: EC00116 & H16057).

2.2. Development of adaptive lessons, data collection and lesson evaluation

The Adaptive Learning Platform developed by Smart Sparrow (Smart Sparrow, 2018), was used to create twenty novel adaptive anatomy lessons. All lessons were designed by a single academic within a teaching session. High resolution photographs of specimens and models that covered over 95% of the 500 structures taught in the subject were incorporated into the lessons. Two styles of high quality lessons were designed to assist students in their learning and to prepare them for weekly practical classes and assessment items: the first ten lessons focused on building student knowledge with drag and drop style questions (Figure 1A and B); the second ten lessons included short answer questions requiring comprehension (Figure 1C and D). The 20 lesons were integrated into a high quality, modern interface to allow easy navigation for students (Figure 2). Immediate adaptive feedback built into each lesson was provided to students based on their individual responses. Types of feedback included (i) an indication of number of correct and incorrect answers, (ii) an additional two attempts for incorrect responses, (iii) display of all correct answers after three attempts and (iv) redirection to a video of the academic pointing to the structure and correctly naming it.

Participants evaluated the adaptive online lessons by consenting to one or both of the following: (1) completing a survey (n=157); and (2) granting access to Smart Sparrow interaction log file data and demographic data (n=124).

The survey contained 12 questions measured on a 5-point Likert scale to assess (i) student motivation and engagement with the lessons and (ii) perceived student learning from completing the lessons. The remaining 8 questions were a combination of multiple-choice and open-ended items. The open-ended questions related to method of accessing the resource, thoughts on design of the learning activities, best and worst features of the adaptive lessons and suggestions for improvements.
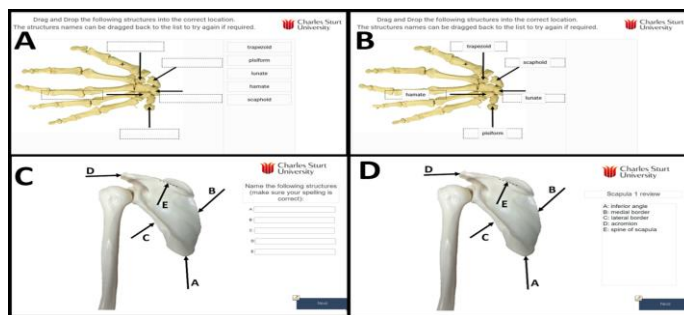
Figure 1. Screenshot of lesson content.
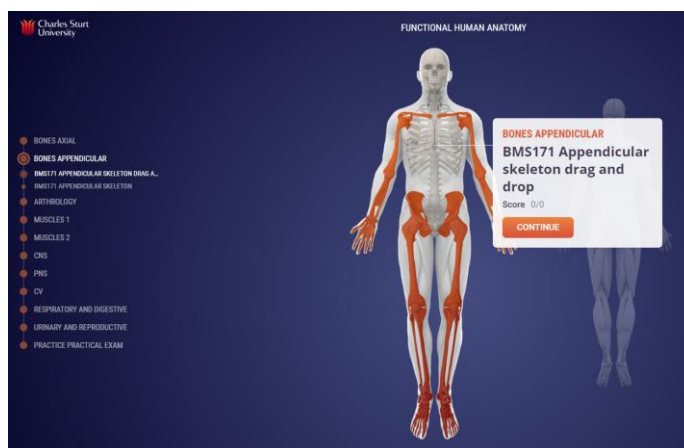
Figure 2. Smart Sparrow interface showing list of available lessons

3. Results

The survey data in combination with analytics revealed that the adaptive lessons were used extensively and repetitively with students not only finding the lessons engaging, but also reporting that the activities assisted with learning and preparedness for practical laboratory classes. The responses were grouped under the following three themes: Engagement and flexibility; Student Learning; and Preparedness for laboratory classes.

3.1. Engagement and Flexibility

Of the 157 students that completed the survey (average age 22 ± 6.6; mean $\pm$ standard deviation), 96% found the resource easy to access. Students were asked where they accessed the resource with most indicating multiple locations of "home" and "university campus". Thirty five percent of students reported completing all of the available lessons and 30% of students completed each lesson five or more times (Table 1).

Overwhelmingly, students self-reported that the adaptive lessons were interesting and engaging. A total of 96% of students agreed or strongly agreed that the resources enhanced overall engagement in the subject while 85% of students found that the interactive resources were fun (Table 2). This is evidenced by the following student comments:

"*Overall a great program, extremely helpful and engaging (mixes up the way I studied).*" Student 69, 2017

"*It was visually interactive which meant I could complete it repetitively and not get bored.*" Student 61, 2017

"*Felt like playing computer games - fun!*" Student 65, 2016

Table 1. Method of access for adaptive lessons. Total numbers for each statement vary as students could select multiple options.

What proportion of the interactive online resources did you complete?	**100%**	**50-100%**	**<50%**	**0%**	**n**
	35%	57%	7%	1%	153
How many times did you complete each of the interactive online activities?	**once**	**twice**	**3 to 4**	**>5**	**n**
	15%	25%	29%	30%	150
I accessed the interactive resources from:	**home**	**work**	**uni**	**other**	**n**
	51%	3%	45%	1%	267
I accessed the interactive online resources using:	**mobile**	**tablet**	**laptop**	**desktop**	**n**
	14%	10%	63%	13%	221

3.2. Student Learning

Ninety six percent of students reported that they learnt a lot by using the resources and that completing the lesson helped 91% to identify priorities for learning. Importantly, the resources made learning more efficient for 88% of students. A total of 93% of students agreed or strongly agreed that resource flexibility assisted in their learning and catered for a range of learning styles (Table 2). This is evidenced by the following comments:

"*Catered for different styles of learning.*" Student 69, 2016

"*It really helped cement knowledge & show where I needed to improve.*" Student 56, 2017

"*All the questions really tested me, and I learnt a lot about what I needed to learn more of, and how to spell structures.*" Student 31, 2017

Seventy nine percent of students agreed or strongly agreed that feedback provided in the online lessons enhanced their learning (Table 2). Two students specifically commented that this function was the best feature of the subject.

"*Easy to use, gives you instant feedback*." Student 66, 2017

"*Good feedback easy to use, good for highlighting gaps in knowledge*." Student 43, 2016

3.3. Preparedness for practical class

Eighty six percent of students either agreed or strongly agreed that the online lessons increased their confidence in the practical laboratory classes and 95% of students reported that the online lessons consolidated their learning after the relevant laboratory class was completed.

4. Discussion and Conclusion

This study provides strong self reported student evidence for the effectiveness of adaptive learning resorces in teaching anatomical content to large, service taught diverse cohorts. In particular, students commented on their motivation and curiosity to repeat the lessons because they were visually engaging and catered to individual learning styles. They also self reported improvements in their learning and laboratory preparedness through repeated use of the flexible and adaptive learning resources. This finding is in line with other previous reports (Chen, 2010; Wong et al., 2015, Green et al., 2018). While we do acknowledge that one of the limitations of this study was the reliance on self reporting, future work will aim to gather quantitative data to determine the relationship between completion of the adaptive lessons and subject success.

Table 2. Self-reported engagement, learning & preparedness from the adaptive lessons.
1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly agree

	1	2	3	4	5	n
Engagement						
I found using the interactive online resources enhanced my overall engagement with this subject	0%	0%	4%	35%	**61%**	152
My experience with the interactive online resources was fun	0%	3%	12%	**47%**	38%	152
Student Learning						
I learnt a lot by using the interactive online resources	0%	1%	3%	38%	**58%**	152
The interactive online resources enhanced my motivation to learn about the topic/s	0%	1%	13%	**47%**	39%	152
The interactive online resources helped me to identify priorities for my learning	0%	1%	8%	38%	**53%**	152
Using the interactive online resources made my learning more efficient (saved time)	0%	1%	11%	41%	**47%**	152
Having access to the interactive online resources met my needs for flexibility in my learning	0%	0%	7%	45%	**48%**	152
The interactive online resource provided feedback that enhanced my learning	0%	3%	18%	**45%**	34%	152
Preparedness for Laboratory classes						
Completing the resources made me feel more confident DURING the laboratory class	1%	2%	11%	**54%**	32%	142
The resources were useful as revision tools AFTER the laboratory activity was completed	1%	0%	3%	46%	**49%**	144

In the current study, students repeatedly commented on the flexibility of the online adaptive lessons, and how it allowed them to study without having to go to the laboratory. More than half of the participants in this study accessed the resources from home and comments about practising in a low risk environment with the online adaptive resources also amplified the learning experience. This helped them to prepare for practical classes and provided a good revision resource for them. While this was important for all students enrolled in the subject,

it was of particular value for online students to prepare them for a week long residential school as previous to this, the only resource they had was access to online lecture recordings. Williams, Birch and Hancock (2012) have demonstrated that there is evidence to suggest that repetitive use of resources leads to better subject outcomes for the student. Indeed, our quantitative findings indicated that students utilised the lessons extensively, with 30% of students reporting that they accessed each lesson five or more times and 84% of students accessed each lesson at least twice. It is therefore pleasing but unsurprising that students felt more confident when attending laboratory classes. Data was also collected on "time spent on the lesson". However, this data was unreliable as many students did not click on the lesson completed button. Any future lessons will be designed to address this so that the lesson engagement time can be analysed.

An additional feature that students valued was the provision of instant feedback, which assisted in their learning and cemented knowledge. Due to limitations to extending laboratory hours for self-guided study outside of class time, the adaptive lessons helped students identify strengths and weaknesses in their knowledge, which they could then concentrate on when laboratory staff were available during class time.

Based on the success of this approach in teaching diverse anatomy cohorts, we are currently evaluating the use of adaptive technologies in other large, service taught subjects such as physiology taught to very large allied health cohorts that include nursing with similar success.

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Integrating Data Analysis and Statistics Across Disciplines

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Abstract

To respond to this increased attention to statistics in society and work force, as well as to contribute to improved career preparation for students, it is imperative that we foster data literacy in our university student population. This paper discusses 13 learning outcomes that describe Advanced Data Literacy for university level students across different disciplines.

Keywords: Data Science; Statistics; Undergraduate Education.

1. Introduction

The demand for people educated in statistics and data science has grown tremendously over the past decade. Jobs related to statistics are expected to grow by about 27% between 2012 and 2022 according to the Bureau of Labor Statistics (Bureau of Labor Statistics, 2013). Key attributes to be successful in such jobs are good computing, analytic and statistical skills, good communication skills, ability to work with real data, ability in storytelling with data both verbally and visually, and the ability to work as a team (Davenport and Patil, 2012).

To respond to this increased attention to statistics in society and work force, as well as to contribute to improved career preparation for students, it is imperative that we foster data *proficiency* in our university population. Following the recommendations of the American Statistical Association put forth in the new Curriculum Guidelines for Undergraduate Programs in Statistics (ASA, 2014), this paper discusses how statistics and data analysis bridges many disciplines and how the different discipline approaches can be integrated. In this paper, we outline a series of common learning outcomes across disciplines for achieving data proficiency on a university campus.

2. Statistics and Data Science Education at the Universities Across Disciplines

Universities typically have several different statistics course offerings across campus. Because it is very common to have statistics courses housed in different disciplines (e.g., mathematics, computer science, psychology, economics), the American Statistical Association (ASA) and Mathematical Association of America (MAA) have offered guidelines for teaching introductory statistics targeted at non-statistics departments (ASA/MAA Joint Statement, 2014). Often times these courses overlap and yet their prerequisite structures do not allow a student to move from a statistics course offered in one department to a more advanced course offered by another department. Departments, often rightfully argue that the type of statistical techniques needed are discipline specific and thus necessitate the offering of a course within a specific discipline.

Although specific techniques do vary from discipline to discipline, certain basic themes of working with data should be present in all courses. Three important, fundamental, and particularly timely themes are that students need to (1) be employing technology, (2) be exploring real data sets, and (3) be practicing communicating statistical ideas and results. Moreover, in all disciplines, statistics should be guided and taught through the statistical investigative process of formulating a question, collecting appropriate data to answer that question, choosing the appropriate analysis technique to answer that question, and interpreting the results to answer the question (Franklin et al, 2007). The material commonly taught in introductory statistics courses often focuses on techniques, but such

methods are often "necessary but not sufficient" for modern data science (Hardin et al, 2015; Ridgeway, 2015).

Several important reports have stated the need for students to work with real data. The Committee on the Undergraduate Program in Mathematics Curriculum Guide 2015 (CUPMC, 2015) states "Working mathematicians often face quantitative problems to which analytic methods do not apply. Solutions often require data analysis, complex mathematical models, simulation, and tools from computational science." This report recommends that all mathematical sciences major programs include concepts and methods from data analysis and computing. The Guidelines for Assessment and Instruction in Statistics Education (GAISE) college guidelines also included working with real data as one of the necessary six components of structuring a statistics course (ASA, 2016). In addition, the recommendations of the ASA on undergraduate programs in data science include Real Applications and Problem Solving as two of their Background and Guiding Principles. They state programs should "emphasize concepts and approaches for working with complex data and provide experiences in designing studies and analyzing real data (defined as data that have been collected to solve an authentic and relevant problem)" (ASA, 2014).

As data science has been described as an intersection of statistics with computer science, when considering undergraduate preparation, one must consider how the use of software interplays with statistics. Regardless of the discipline, technological fluency has become a must for success in the workforce. Therefore, university statistics and data science courses must incorporate heavy use of technology and computing.

Working with technology, working with real data, and communicating results provide the unifying themes for statistics and data science course offerings across campuses. If a model existed for what courses should look like across different departments that were centered on such themes, then the door may open for students seeking statistics and data science beyond what their departments offer.

2.1. Teaching and Learning of Statistics and Data Science at Universities

Much research has been dedicated toward uncovering best practices for undergraduate students' learning of statistics. This research has largely targeted introductory statistics courses. A focus of the research has been to identify statistics topics and concepts that students have difficulty learning (Garfield & Ben-Zvi, 2008). Often students rely on "plug-and-chug" methods to solve problems without understanding the statistical ideas being discussed (Chervany et al., 1977; Stroup, 1984; delMas, 2004).

As noted by Horton & Hardin (2015), little research has targeted statistics learning beyond the introductory course. Given the the rapid growth of statistics and data science, it is important for research to "catch up" and inform best practices in developing, implementing,

and assessing programs. In addition, understanding how data science and computing interplay with statistics program offerings is currently an under-researched topic. Data science, as described by Baumer (2015), is "an emerging interdisciplinary field that combines elements of mathematics, statistics, computer science, and knowledge in a particular application domain for the purpose of extracting meaningful information from the increasingly sophisticated array of data available in many settings." Some researchers have successfully implemented data science courses at their institutions (e.g., Hardin et al, 2015, Baumer, 2015) with similar student learning goals.

2.2. Statistics and Data Science at Loyola Marymount University

The National Science Foundation (NSF)-funded project (NSF Grant No. 1712296), *Undergraduate Data Pathways* (UDaP), focuses on understanding differences and similarities of statistics and data analysis course offerings across different disciplines. Using Loyola Marymount University (LMU), a mid-sized comprehensive university in Los Angeles, California that offers 53 major and 57 minor undergraduate programs; 31 master's degrees; one doctoral degree; and 15 credential programs as a case study, the project defined a set of learning outcomes that integrated the statistical goals put forth by several different disciplines.

While LMU does not have a department dedicated to statistics or data science, the Department of Mathematics, Department of Biology, Department of Engineering, Department of Economics, Department of Political Science, Department of Psychology, Department of Sociology, the School of Business, and the School of Education offer courses related to statistics and data analysis. Several of the introductory courses offered in these departments overlap in content thus creating an appearance of duplication and potential wasted resources across campus. Furthermore similar courses in one department are often not accepted as prerequisites for higher-level statistics offered in another department, thus blocking the pipeline for students to advance their statistical knowledge. Because of LMU's breadth of programs, its size and relatively typical situation regarding statistical course offerings, the findings for LMU can provide a model for other universities wishing to unify statistics offerings across disciplines around working with real data, technology, and emphasizing communication.

3. Processes

Five steps have been undertaken to research the differences and commonalities of statistics and data analysis across disciplines. As a first step, a faculty working group with representation from mathematics, economics, biology, psychology, sociology, business, and statistics was formed. The working group was centered around understanding the processes and support needed to implement the themes of communication, technology, and real data

in statistics courses across the disciplines. Four meetings per semester have consistently been scheduled over the course of the last two academic years. The purpose of the working group discussions is to gather qualitative data on how the different disciplines articulated the importance of statistics and to reach common ground to understand what all of the discipliens had in common.

The second step in the process was to develop and administer a 15 minute survey to the working group. The survey asks about the software platforms they used, data sources they used, the types of class assignments they gave (e.g., statistics investigations in the form of projects, problem sets), and the types of activities they used in the classroom (e.g., students using computers in a lab setting, group work). The survey included questions from the NSF-funded Statistics Teaching Inventory (STI) surveys developed by Zieffler et al. (Zieffler, 2012) focusing on their teaching practice, assessment practice, teaching beliefs and assessment beliefs.

A third step was to review any position statements, policy documents, or curriculum guidelines written by professional organizations regarding data proficiency to understand whether there was common ground between the disciplines.

A fourth step included carrying out a survey to the community, both academic and non-academic, to garner their thoughts on the necessary learning outcomes for statistics and data analysis at the university level.

Lastly, the culminating step of the work was to develop a set of learning outcomes for teaching and learning data-related courses based on the findings of the prior steps. Thirteen such learning outcomes were agreed upon.

4. Findings

The Table 1 presents the final 13 learning outcomes that were established as important for students to meet at the university level. Students meeting these learning outcomes are deemed to be *Advanced Data Literate*.

The learning outcomes span both content and process. The important themes of using real data, communication with data, and technology are well-represented withing the learning outcomes as well. These outcomes are meant to be broad and cross-disciplinary so they can serve as benchmarks across all disciplines offering statistics and data analysis courses. These learning outcomes stemmed from the extensive discussions within the working group as well as the review of the policy documents and the community survey.

Table 1. Learning Outcomes and Descriptions

Learning Outcomes	Descriptions
1	Students formulate and/or address questions about univariate data, collect/consider univariate data, analyze univariate data, and interpret results
2	Students understand, calculate and interpret descriptive measures for quantitative and/or categorical variables to describe characteristics of the data
3	Students create and interpret basic data visualizations for quantitative and categorical variables
4	Students understand, carry out, and interpret basic inferential statistical procedures for one or two samples
5	Students understand, carry out, and interpret results from estimating statistical models for bivariate data (e.g., linear regression, interpolation, extrapolation, predictive inference)
6	Student carry out and communicate results from extensive data-driven project(s) that is related to a real-life problem (extensive means that a single project takes more than two weeks to complete or a series of projects take more than two weeks to complete and are worth at least 25% of the final grade)
7	Students communicate their analyses and the interpretations of their results in a manner that is appropriate to their discipline in the context of the data (e.g., communication could be emphasized with presentations, oral explanations of results, oral/written answers for in-class work, written explanation of results)
8	Students understand the implications of study design, can select appropriate statistical methods for data analysis, and can explain limitations of their analyses and interpretations
9	Students become critical consumers of statistically-based results reported in popular media, recognizing whether reported results reasonably follow from the study and analysis conducted
10	Students formulate and/or address questions about multivariate data, collect/consider multivariate data, analyze multivariate data, and interpret results
11	Students use current statistical software or statistical packages that are appropriate to the discipline and context beyond basic Excel or a calculator
12	Students write a program (using a programming language) to analyze data or extract information from the data
13	Students study at least one type of advanced data-analytic methods such as (not limited to): generalized linear models, Bayesian analysis, advanced probability theory and stochastic processes, non-linear models, machine learning, advanced study-design, big data analysis, econometrics, or statistical computing

Policy documents. Six curriculum guidelines were found from various professional oraganizations that specifically dicuss students' necessary data literacy. Each of these documents was reviewed to cross-check whethere the learning outcomes were explicitly mentioned. Five difference disciplines are represented in the policy documents; Mathematics, Statistics, Psycholoy, Economics, and Sociology. The Table 2 presents the results.

Table 2. Professional Organization Alignment with Learning Outcomes

Learning Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	13
American Statistical Association (ASA)	X	X	X	X	X		X	X	X	X	X	X	X
Mathematical Association of America (MAA)	X	X	X	X	X		X	X	X	X	X	X	X
Guidelines for Assessment in Statistics Education (GAISE)	X	X	X	X	X		X	X	X	X	X		
American Psychological Associaion (APA)	X	X	X	X			X		X	X	X		
American Economics Association (AEA)	X	X	X	X	X		X		X	X	X	X	X
American Sociology Association (ASA)	X	X	X	X		X	X		X	X	X		

Table 2 illustrates that eight of the learning outcomes were discussed in all of the policy documents. The remaining five learning outcomes were supported by three of more of the documents. Only in one case, the extensive project, was the learning outcome not well-supported. In this case, the documents did not discuss the need for a project, however, they also did not suggest that an extensive project was a bad idea. A project offers students a way to connect ideas in a coherent manner and further work on their communication. It also

provides an opportunity for students to work extensively with real data as well as technology to carry out the analyses.

To further validate the learning outcomes, a community survey was administered online. The online survey was sent out by members of the working group to their connections, was sent out of list serves for several disciplines, and was posted on a few forums. A total of 367 people opened the survey and 287 people completed the survey. The following pie graph show the distributions of backgrounds of people who completed the survey.
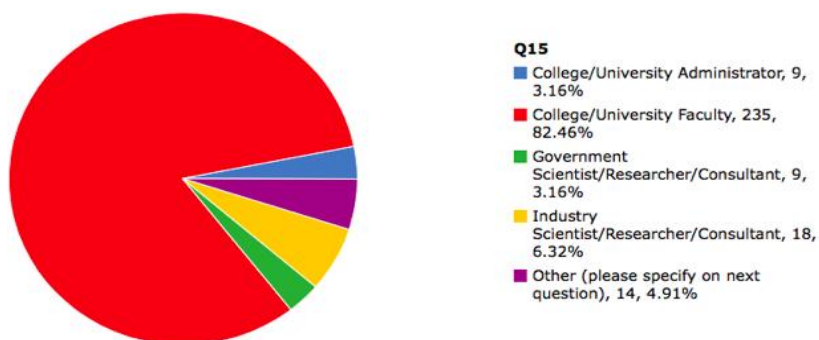
Figure 1. Distribution of backgrounds.

The next table shows the percentage of survey respondents that agreed, were neutral, or disagreed with the statement that the learning outcome was an important skill that a university student must acquire.

Of the 13 learning outcomes, four of them had 90% or above of the 287 people in agreement that they are important skills that a university student must acquire. Another five learning outcomes had a large majority of respondents state that they agreed or were neutral. Only three learning outcomes had large disagreements with the statatements.

As a result of the findings, the 13 learning outcomes were deemed to describe an Advanced Data Literate student. A student meeting less of these outcomes could be labelled at lower levels of data literacy.

5. Conclusions and Future Research

The main goal of this paper is to outline 13 learning outcomes for statistics and data literacy at the university level. As society pushed towards being more data-driven, it is important to understand and characterize what education should be doing as a response. The common learning outcomes in statistics and data science across disciplines focused around three important themes in data science: working with real data, communication, and technology.

This project is ongoing and the findings are expanding. This paper offers the important initial step in finding common ground across disciplines. The creation of a working group of "change agents" on a university campus that have interest in furthering data proficiency in students has been an invaluable asset to the project. To be effective, these change agents must come from different disciplines. The formation of a working group of invested change agents is no easy task. For the formation of such a group at LMU, we saught the help of the Associate Dean for Undergraduate Studies who urged faculty that had investement in statistics to join the group. In addition, members of the research team personally reached out to faculty in other departments to encourage them to join the working group. In total, a working group of 10 faculty was set up.

Future work for the project includes reviewing enrollment data and all of the courses offered at LMU. The goal is to contribute a comprehensive picture of what is happening at the university level sorrouding statistics and data science.

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Internationalization @ home in Engineering Education: Enhancing Social Capital in English-taught Master´s Programmes

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Abstract

German higher education institutions attract students from all over the word for degree mobility, especially after the Bologna reform has led to an increase in internationally-oriented, English-taught study programmes. With such programmes, universities serve the politically intended purpose of attracting highly qualified talent in the form of international graduates that might potentially stay for the German job market. But for the transition from studies to the work market to be successful, it is essential for international students to acquire social capital in the form of contacts to people from the host country.

This paper firstly presents results of a study on the situation of students who come to study in international engineering programmes at the Ruhr-Universität Bochum in Germany, focusing on the unsatisfactory contact situation of international and German students revealed in the study. Secondly, measures of the project ELLI2 – Excellent Teaching and Learning in Engineering Sciences – are introduced that aim at improving this situation, fascilitating contact between German and international engineering students. The set-up of a tandem-programme is presented, as well as participation structure and evaluation results of the first two runs of this programm in 2017/18. In addition, an international student council network will be introduced.

Keywords: Engineering Education; Internationalization at home; Bologna reform; Globalization; Social Capital.

1. Introduction

Since the Bologna reform, the implementation of a two-stage system of study programmes has made great progress in Germany. The influence of globalization tendencies on the German higher education system has also led to a wide-spread development of international study programmes, particularly master degree courses. Today, there are more than 1,100 internationally oriented programmes on the master's level and 160 international Bachelor programmes in Germany: German Academic Exchange Service, DAAD (2019). The engineering disciplines were among the first to implement international (English-taught) programmes, partly in order to make up for their shrinking student numbers in the final years of the old millennium: Maiworm (2002). Great potential is seen in such programmes to attract talent from all over the world, possibly with the perspective of staying on to work in the German labour market, especially in the much sought-after technical fields of study.

At the engineering faculties of the Ruhr-Universität Bochum (RUB), the Project ELLI2 aims at improving the conditions of teaching and learning in engineering education. The cooperative project of three German universities started off in 2011 and is funded within the "Qualitätspakt Lehre" (Teaching Quality Pact by the German Federal Government and States). The project's key area *Globalization* takes into account the latest challenges for internationalization and diversity in higher education contexts. The central goal of all its measures is to add an international component to higher education in engineering sciences by increasing the dialogue between international and local students in and around study programmes, for example by shared events and lectures.

In 2014 and 2015, the project had conducted workshops and qualitative interviews with the study coordinators and heads of the RUB's three international master's programmes in engineering sciences, identifying challenges of international study programmes and elaborating concepts to improve the contact situation of international and German students in such programmes. The results of this preliminary study were presented at the second HEAd conference: Strenger; Frerich (2016).

This paper gives an overview of a follow-up investigation of the student's view that was based on those preliminary results and realized via a quantitative survey and qualitative interviews among the international master's students. It furthermore presents different approaches of internationalization at home which the project ELLI2 has implemented in 2017 and 2018 in cooperation with the RUB engineering faculties. These measures deal with the challenges identified and aim at increasing the possibilities for international engineering students to acquire social capital through contact with German students.

2. Problem: Lack of Social Capital in International Master's Programmes

At the RUB, the three engineering faculties Mechanical Engineering, Electrical Engineering and Civil and Environmental Engineering hold a total of 10 study programmes, including three internationally-oriented Master degree courses, which are taught 100% in English: *Laser and Photonics*, *Computational Engineering* and *Materials Science and Simulations*. Although they are open to German and international students alike, the student body of these three programmes comprises hardly any Germans. Most students are from (East) Asia, the main countries of origin being India, Pakistan, Syria, China and Iran.

The preliminary investigation in 2014 and 2015 had focused on the faculties reasons for implementing such international programmes, revealing a strong interest to gain potential doctoral students in highly specialized fields that were rarely chosen by German engineering graduates. With regard to the study situation of the international students, one of the central hypotheses derived from the interviews with study coordinators was that, due to the distribution of nationalities in the programme, contact opportunities with the host country would be scarce, thus limiting the possibilities of acquiring social capital. (Social capital, according to the late French sociologist Pierre Bourdieu, comprises all social, societal and familiar relations which can occur in a more or less institutionalized form and rely on social acts of exchange to be converted, e.g. into economic capital in the form of job opportunities through contacts to employers: Bourdieu (1983).)

In order to test this hypothesis from the students' point of view, a two-stage investigation was conducted in 2016, that comprised a quantitative online-survey with 84 participants and a follow-up study with a total of 17 semi-structured, qualitative interviews that served to either confirm or disprove the survey results: Strenger (2019).

2.1. Results of the investigation

As indicators for opportunities to accumulate social capital during their studies in Germany, the participants of the survey were asked how much contact they have to a) international students (except students from their own home country), b) students from their home country and c) German students (on a scale from 1-7, 1 meaning "very much contact", 7 "no contact at all). The results indicate a clear lack of contact to Germans:

In the context of your studies at RUB, how much contact do you have with…

Figure 1. Contact situation of international students in English-taught programmes. Source:Strenger (2019).

Only one person states to have very much contact to German students. The cumulative percentage of contact to Germans reaches 23% on the first three ranks, while a total of 40% state that they have no contact at all (10%), or almost no contact at all to German students. 36% state to have very much contact to international students, with a cumulative percentage of 85% on the first three ranks. 32% state that they have very much contact to students from their own home country, the cumulative percentage amounting to 69% on the first two ranks.

Asked with which one of these three groups students have the most contact, 56% state that they are mostly in contact with international students and 43% state that they have the most contact to students from their own home country. Only 1% of all international students state that they are mostly in contact with German students while studying in Germany.

With which of these groups do you have the most contact?
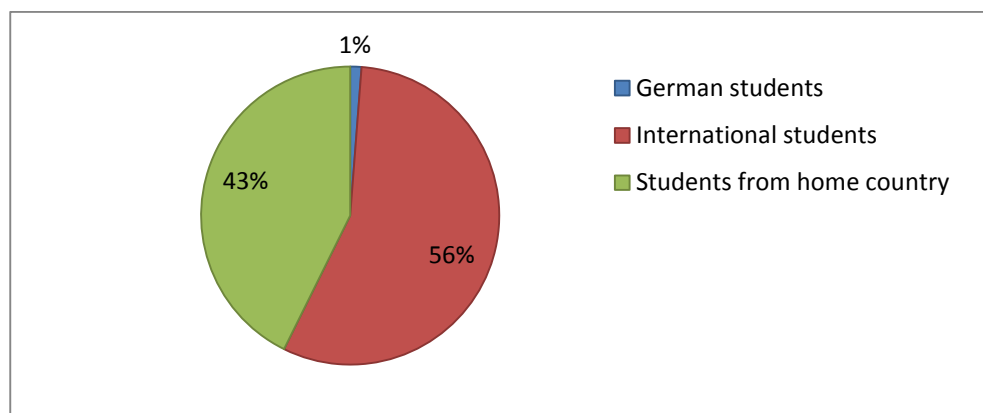
Figure 2. Most contact of international students in English-taught programmes. Source:Strenger (2019).

The initial hypothesis that international students in these internationally oriented, English-speaking programmes lack contact with students of the host country, was verified by these results of the quantitative study.

In the qualitative interviews with students, this was supported further, sheding light on the very special situation of international students who migrate to Bochum for their entire master's studies. The interviews revealed that it is not only in their study environment, but also in their residential environment that international students stay mostly among themselves, for campus accommodation is organized for them during their first semester, and it is mostly foreigners living in the dorms on Bochum university campus. The very few students who have much contact to German students seem to be those who were able to find a housing situation apart from those dorms, in an appartment together with Germans.

One student summarizes her study experience in Germany as follows:

> "I can be in this international bubble and it´s cool - you keep meeting people from a lot of different places. But for me, it´s interesting because you can be in Germany and really not learn the language and not experience the culture, it´s weird."

Based on the results of this investigation which clearly point to a lack of social capital with regard to their host country among international engineering students, the project ELLI2 in its second funding period since 2016 has established measures to improve the contact situation between international and German engineering students.

2. Solution: Internationalization at home in RUB´s Engineering Faculties

Whereas traditional definitions of internationalization emphasized primarily on mobility of students, an increasing number of higher education experts estimate that mobile students will make up only a relatively small proportion while internationalization at home (IaH) is a more convenient approach to summarize all internationalization activity aimed at the whole student body, including international and intercultural dimensions into the course of studies: Beelen; Jones (2015).

Engineering students in Germany still do go abroad less than average: German Academic Exchange Service (2017) and at the same time, it is an aim to increase the immigration and stay of highly educated engineering graduates due to labour shortages and the lack of suitably qualified doctoral candidates. Therefore, it was the project ELLI2´s aim to implement concepts to bring international and local students together. By doing this, more internationalized experiences and more dialogue between students with different backgrounds for improving cultural competences and language skills for both groups should be promoted to benefit from the international potential already existing within the

home university. In the following chapters, two measures with the most characteristic features and outcomes will be introduced.

3.1. Tandem.MINT programme

Tandem.MINT is a peer-learning concept for increasing intercultural competencies and language skills for local and international students of Natural Sciences & Engineering (STEM) in order to increase IaH by a shared peer-learning-concept. In a classical tandem, two different native speakers practice the other one´s language. The participants shall develop both their language and intercultural skills. As both tandem-partners are students of STEM-disciplines, they can refer to subject-specific contexts and improve their use of technical language. In the tandem-partnership, students practise working together professionally in multilingual and culturally heterogeneous teams. Thus, they acquire transferable skills for the increasingly globalised working environment in the field of Engineering and Natural Sciences. In the pilot project, students can either obtain credit points or a certificate. The pilot startet in summer semester 2018 with a high demand from engineering faculties with 41 of 45 applications coming from engineering courses. One third of the applications came from students of the English language master's programmes.

Most of the local students aimed to improve their English skills while almost all international students with advanced English skills wanted to improve their German skills with a tandem partner. As the demand for English language could not be met by English native speakers on the one hand and the native languages of the international students such as Hindi, Malayam, Arabic or Chinese were not demanded by the local students, the matching rules for the tandem programme had to be improved.

As the tandem.MINT programme is primarily a measure for increasing the dialogue between local and international students, this was an ideal challenge to meet students needs: The solution was to match advanced English-speaking international students for the target language. This way, a maximum of international students could be matched and these students experienced a setting on equal terms (as opposed to other dialogue concepts such as buddy programmes, which are rather one-way-benefit concepts). All students were informed about this change and almost none refused his or her participation.

At the end of the summer semester, all eight learning couples finished the programme successfully and they reported great intercultural and language development and emphasized on their benefits of learning with a partner he or she otherwise probably would not have met. The ongoing second pilot started in winter semester 2018/19. The demand from engineering students almost doubled and 16 pairs, mainly for English and German, are learning together. In a mid-term reflection session, all participating students reported that they benefit from this individualized learning where they can define contents and learning

tempi individually. They value learning with a student partner who is not part of their regular peer-group as a realistic preparation for the international job market.

3.1. Meetings of engineering student councils

Another measure implemented successfully by the project ELLI2 is as simple as effective: organized meetings of all engineering student councils. As student councils are the multipliers to their student bodies, those meetings which are organized by the project are valuable in multiple ways: students from different study courses get the chance to network and to exchange views about common issues, challenges and events.

After implementing those meetings, council members asked the project to continue organizing and chairing the quarterly sessions as hosts. Since 2017, council members from the English-taught master's programmes join the meetings as well. Since then, the meetings are held in English. Usually, ELLI2 does not set the agenda for the meetings but staff members ask the councils prior to each meeting for issues to talk about. In addition to that, ELLI2 regularly introduces seminar offers or announcments within that circle.

When council members of the international master programmes started joining the meetings it turned out that students from both the German and English language study courses did not know much about each other until then. Some German council members for example did not even know about the existence of the international master's programmes at their faculties, whereas their international fellows did not know all the regular engineering study courses although there are some common seminars. In these meetings, the students discuss teaching evaluations and they look for solutions for shared problems. Besides, the ELLI2 student council meeting is a platform to organize joint events in order to network beyond the borders of a single study course. All council members report a significant benefit from those meetings. According to them, there were almost no points of contact at all with the other student groups before joining this overall student council meeting and they highly appreciate having an organized format now to increase the dialogue.

4. Conclusions and Outlook

While the internationalization of higher education in Germany has made great progress during the last two decades, the implementation of international study programmes alone does not seem to be enough to create an atmosphere of real internationality: The investigation results presented in this paper indicate that, when it comes to interaction between international and German students, there is much room for improvement. Different measures of ELLI2 were presented which aim at adding an international component to engineering education by increasing the dialogue between international and local students.

The experiences made with these approaches indicate that IaH is working and highly appreciated by international and German students alike.

ELLI2 will go on until the end of 2020, by then, two more years of the Tandem.MINT programme and the council meetings will be evaluated. The project will strive for a continuation of its programmes within the RUB engineering faculties that goes beyond the funding period of the Quality Pact for Teaching and Learning. Through constant dialogue with stakeholders at central university level, in the faculties and with student representatives, it seems likely that pilot projects like Tandem.MINT and the organized council meetings will be continued. One interim result of both measures is that students do demand offers for getting in touch with each other but there are ongoing efforts to make in order to establish contact and dialogue on a regular basis which is independent from external support elements. The final objective should be to have more elements of internationalization at home within the curricula of all engineering courses.

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Combining DoV framework and methodological preconceptions to improve student's electrical circuit solving strategies

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Abstract

Our research studies about student's prior knowledge acting as learning difficulties (referred to as preconceptions) in electricity courses at university level led us to define knowledge as the association of two elements: a model and a domain of validity (DoV). This statement is the core of the DoV framework. This framework reveals its powerfulness in the way it helps teachers to map students' cognitive structures, to identify their preconceptions as well as to derive effective teaching strategies. Quantitative experimentations we carry out indicate a lack of global circuit solving strategy among students. Especially, they highlight the fact that the difficulties encountered by those students in network analysis are not that much relying on the mastering of solving methods but on the method selection process. This lack of solving strategy prevents the students to grasp the domain of validity of the solving methods they master, so to associate the relevant methods with the suitable circuits. This paper depicts how the application of the DoV framework to this problem-solving process reveals to be a great tool to identify and tackle students' (methodological) preconceptions as well as to formalize, rationalize and simplify complex solving strategies making them easier to explain, teach and learn.

Keywords: Preconception; domain of validity (DoV); electricity; network analysis; problem-solving process; solving strategy.

1. Introduction

It is widely acknowledged that students come to courses with difficult-to-change prior knowledge (referred to as *preconceptions* in this paper) at both pre-university and university level, in particular in general physics education. Since several years, we are studying this phenomenon in circuit theory. Various experimentations led us to propose an original and formalized conceptual framework based on the concept of Domain of Validity: the DoV framework. This DoV framework reveals its usefulness and its powerfulness such as a frame of reference to better understand, identify and assess students' preconceptions or as a tool from which effective teaching strategies can be derived. The application of the DoV framework through experimentations (preposttest design, interviews, case study, etc.) with different research questions and objectives offered promising results (Sommeillier & Robert, 2017).

We go further in this paper by applying the DoV framework to complex problem-solving processes and by introducing the concept of *methodological preconception*. This new perspective is motivated by quantitative past examination and laboratory test analyses revealing that the difficulties encountered by the students are at least as much relying on the method selection process (i.e. the ability to select the most relevant and efficient method(s) to solve a circuit) as the mastering of solving methods themselves. This application of the DoV framework reveals to be a great tool to formalize, simplify and so to more effectively teach complex solving strategies. Several authors among have provided very interesting analyses about students' reasoning in circuit solving (Andre & Ding, 1991; Langlois & Viard, 2014; Viennot, 1979), but – according to us – with different perspectives and contexts.

Section 2 depicts briefly the seminal ideas of the DoV framework and how it integrates the concept of "preconception". Section 3 introduces the "methodological preconception" as an expression of a students' lack of global circuit solving strategy. Section 4 highlights the benefits of transposing the DoV framework to the network analysis process.

2. Domain of Validity framework

We study students' learning difficulties caused by prior knowledge in an engineering school. This approach prompted us to model the observed phenomena and derive an explicit teaching strategy to address these difficulties. We present in this section a conceptual framework we call the *DoV framework*, whose key concept is the *domain of validity* (or *DoV*) of a knowledge. This framework is based on two main assumptions (Subsections 2.1 and 2.2).

2.1. Knowledge is the association between a model and a DoV

We analyzed and summarized seminal ideas from existing constructs about prior knowledge (Sommeillier, Quinlan, & Robert, 2019): misconceptions, alternative conceptions, anchoring

conceptions, phenomenological primitives (p-prims), threshold concepts, cognitive obstacles and conceptual changes (Posner, Strike *et al.*, 1982; Smith, diSessa *et al.*, 1994; Vosniadou, 2012) – to mention a few authors among many others. In most of those constructs, *knowledge* (or *conception* or *model*) is the central – if not sole – element of the cognitive structure. Discussion across the various constructs then tends to center on how valid that knowledge is in relation to expert views. We will refer to this these assumptions (knowledge is "atomic", and its validity is the focus of debate) as the *monolithic view* of knowledge.

Instead, we hypothesize that knowledge consists of *two* connected elements: a *model* and a *domain of validity* (*DoV*). Both the model and the DoV are part of an individual's cognitive structure, hence their *knowledge*. The DoV is the bounded area within which the *model* properly describes "real-life experiences". Figure 1a illustrates this view: a piece of knowledge is the association of a model M1 and a domain of validity DoV^1 (represented by the rounded-corner box). The dots represent real-life experiences. Some of the dots are inside DoV^1 (white dots), while others are outside DoV^1 (black dot): M1 properly describes the three "white-dot" real-life experiences, but not the "black-dot" experience. These "experiences" include situations students may face in everyday life (observations, experiments, etc.) as well as situations created by the teacher (exercises, labs, problems, etc.).
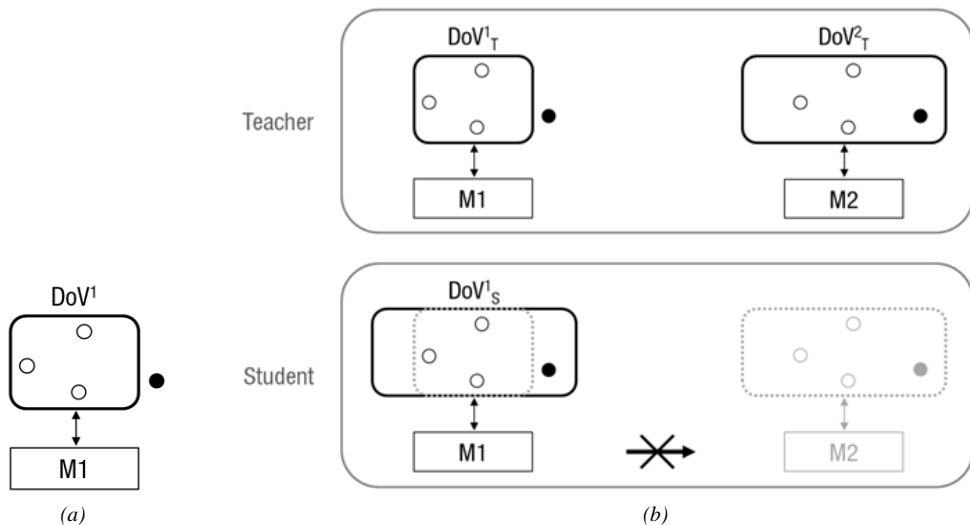
Figure 1. (a) Knowledge is a model associated with a domain of validity (DoV)
(b) Graphical formalization of the DoV framework

As a consequence of this hypothesis, there is no single "right" model surrounded by "false" models; models just coexist, having different DoVs. As a simple example, the model of the flat Earth is extremely useful and highly accurate when building a house, but disastrously

inaccurate when launching a satellite. The coexistence of the classical mechanics (Newton) and the theory of relativity (Einstein) is another well-known illustration.

Introducing the DoV concept allows us to capture the fact that a model is sufficient in many circumstances, but not all circumstances. This situation is depicted at the top of Figure 1b (representing the teacher's cognitive structure) where two models M1 and M2 are both valid but in different DoVs. It leads us to abandon the idea that a conception is "right" or "wrong" and opens the door to multiple valid conceptions coexisting. According to us, explicit recognition of DoVs is today lacking in existing teaching strategies.

2.2. Preconception is the association between a model and an overgeneralized DoV

The second DoV framework hypothesis is that very nature of a preconception consists of an *overgeneralized DoV* (or *ODoV*): a domain of validity too wide relative to what the associated model can really represent. This simple hypothesis explains many phenomena related to prior knowledge. It also suggests that the typical blocking situation experienced in learning is due to the monolithic view of knowledge itself, held by the teacher and/or student.

Referring to the cognitive structure depicted on the top half of Figure 1b, this teacher has two models in mind, with different DoVs, both coexisting without contradiction. One black-dot experience (launching a satellite into orbit) is properly described by M2 (round Earth) but not by M1 (flat Earth). The bottom part of Figure 1b depicts the cognitive structure of students who possess a preconception related to M1: the students possess the same model M1 as the teacher but associated with an ODoV (including the black-dot experience covered by M2).

When the teacher presents the students with a black-dot experience for the first time (for which M2 is a better fit), students will use M1 according to their own cognitive structure (especially if the student is not conscious of a structural difference between this black-dot experience and the white-dot experiences). The student is confident in M1 because using it in the past has resulted in positive feedback from the teacher.

Our hypothesis also explains why, even when students understand M2, they may continue to apply M1: it is different to remember, understand, explain or even apply a model (which involves only the model itself) than it is to select an appropriate model when facing a real-life experience (which involves both the model and its DoV). Students could have learned and remembered a model M2 without having modified the DoV of a model M1.

3. Network analysis and methodological preconception

In the considered electricity course for 2nd year engineering students, the main learning outcome is to be able to solve electrical circuit problems, more specifically to perform efficient network analyses. Network analysis is the process of finding the voltages across,

and the currents through, every (passive and linear) component in an electrical circuit. The circuits covered in this course include all circuit types from the most basic DC circuits with purely resistive components in steady state to the most complex AC circuits with reactive components and transient (Figure 3). When looking at solving any circuit, a number of methods and theories exist to assist and simplify the process. There are many different techniques for calculating these values, from electrical laws to mathematical tools.

We analyzed the answers provided by 796 students in past examinations (Sommeillier & Robert, 2017). This examination analysis indicates the difficulties encountered by the students are at least as much relying on the method selection process (i.e. the ability to select the most relevant and efficient method(s) to solve a circuit) as the mastering of solving methods themselves. In other words, when facing a new problem (or felt as if), students tend to improvise, which consists in ignoring what they fully master. This phenomenon is enhanced by the absence of a global solving strategy.

A laboratory test analysis we are undertaking leads to the same outcome. Figure 2 shows an example of those laboratory tests submitted to each student at the beginning of lab sessions. The aim of this question is basically to solve an AC circuit with a reactive component in steady state (Circuit type 7 in Table 1). The data analysis reveals that among the 156 students having passed this test, only 46 students (29%) answered a voltage amplitude of 5V which is the right answer. 76 students (so 49%) answered 7V and 34 (22%) didn't provide a numerical answer. This is due to the fact they – almost half of all 156 students – tried to solve it in the time domain ($3 + 4 = 7$ by simply adding the voltage amplitudes) instead of in the frequency domain ($\sqrt{3^2 + 4^2} = 5$ by using adding the corresponding phasors) as explicitly defined in all the course material and already practiced during exercise sessions. Thus, having no global solving strategy, students tend to apply a solving method outside of its relevant DoV.
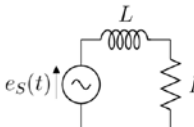
Figure 2. Laboratory test example with a reactive circuit with AC source in steady state (Circuit type 7 according to Table 1) – Translated from French

Regarding the DoV framework, this lack of strategy can be expressed in terms of *methodological preconceptions*. A methodological preconception is defined in the DoV framework identically to a classical preconception (Subsection 2.2): the association of a

model with an overgeneralized DoV, with the particularity that the model referred to as a solving method and the DoV as a set of circuit types.

4. DoV framework applied to electrical circuit solving strategy

Being able to select the relevant methods for any circuit seen in this electricity course is not trivial. Indeed, the different circuits the students can face is infinite, the solving methods are numerous, and they can present slight differences in solving efficiency depending on the considered circuit types. Formalizing the method selection process and the steps required to solve any type of circuit illustrates the intricacy the students have to face.

By splitting the analysis in terms of DoVs on one hand and in terms of models on the other hand, the DoV framework reveals its powerfulness in its ability to formalize, simplify and categorize the constitutive elements of the global circuit solving strategy we are seeking for. First, focusing on the DoVs – and so on the different circuit types seen in network theory – it's worth to note that each of those circuits can be characterized by three binary parameters: the nature of the passive components (resistive or reactive), the type of power supply (DC or AC) and the fact that the circuit is permanently in steady state or that it presents a transient (absence or presence of a switch). Three parameters having each two possibilities give $2^3=8$ possible circuits. They are listed in Table 1. Figure 3 gives two basic examples of circuits of type 1 and type 8, while Figure 2 above presents a circuit of type 7.

Table 1. Eight type of electrical circuits depending on three criteria

Circuit type index	1	2	3	4	5	6	7	8
Component type	Res.	Res.	Res.	Res.	Rea.	Rea.	Rea.	Rea.
Power supply	DC	DC	AC	AC	DC	DC	AC	AC
Switch presence	Yes	No	Yes	No	Yes	No	Yes	No

(a)   *(b)*
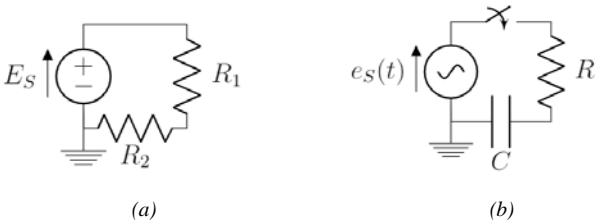
Figure 3. Examples of electrical circuits: (a) Circuit type 1 and (b) Circuit type 8

This circuit characterization allows to apply easily the DoV framework. Following the formalization depicted in Subsection 2.1, the idea is to identify for which circuit types each method is relevant or not. For instance, independently of the power supply type and of the presence or the absence of a switch, the "classical" solving method is suitable for circuits with purely resistive components (circuit types from 1 to 4). The fact this classical solving method is relevant for some circuit types and not for the others can be modelized by the graphical formalization of the DoV framework (Figure 1a). In this transposition (Figure 4a), the considered solving method is what we called the model in Subsection 2.1 and this model M1 is associated to the DoV in which its use is relevant: a set of circuit types 1 to 4 (i.e. a set of "real-life experiences").
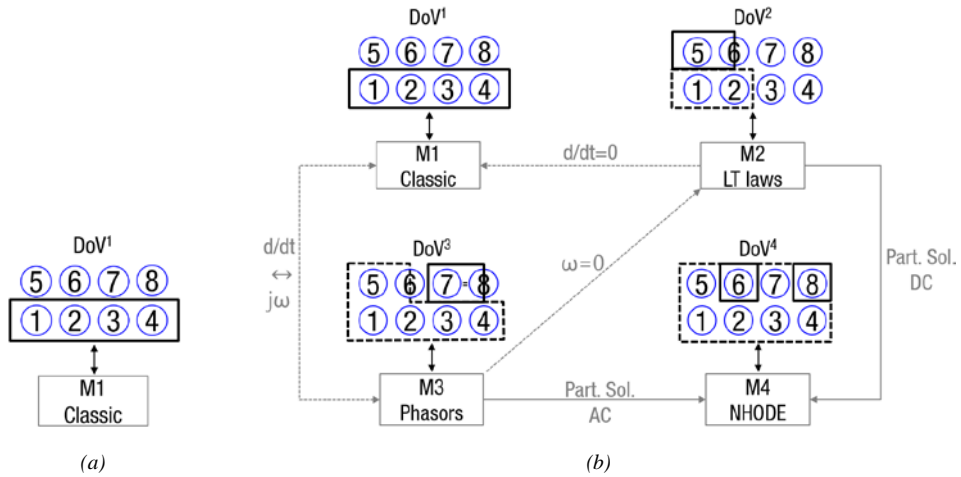
Figure 4. (a) First assumption of the DoV framework applied to one solving method.
(b) DoV framework as a tool to formalize and rationalize a global circuit solving strategy

In this framework, a methodological preconception consists in applying the model outside the appropriate DoV. For instance, referring to the example illustrated in Figure 2, applying the model M1 (classical solving method) to the real-life experience 7 (AC circuit with a reactive component in steady state) reveals the presence of this preconception. Processing similarly for each solving method allow us to radically simplify and rationalize the network analysis process which make it easier and more effective to teach. This study leads to a powerful formalization of a global circuit solving strategy illustrated in Figure 4b.

Combining the DoV framework and the methodological preconception to efficiently map students' erroneous method selection in a formalization including only four models (solving methods) for eight circuit types. Confronting the DoVs appropriated to a model to the (potentially erroneous) DoV associated by the student to this model enables to easily identify the nature of the obstacles and to build a teaching situation helping to make the student aware of this obstacle and to overcome it efficiently. More generally, this formalized result widens

the possibilities in rethinking the ways circuit theory and network analysis are taught from the identification of students' difficulties to the development of teaching strategies.

5. Conclusion

Network analysis is a fundamental learning outcome of any electricity course for which students encounter strong difficulties. Our experimentations indicate the difficulties encountered by the students are at least as much relying on the method selection process as the mastering of solving methods themselves. Applying the DoV framework to this problem-solving process enables to formalize and simplify this process. Combined with the methodological preconception, the DoV framework is a powerful tool to better identify students' difficulties in circuit solving and it offers a useful perspective to conceive efficient teaching strategies. This way to apply the DoV framework is not bounded to network analysis, to circuit theory or even to physics. More investigations have to be done to implement this approach in other fields and education levels. We are currently working on the development of a science-learning app in which a DoV-based teaching strategy is implemented in order to help students from all around the globe overcoming their preconceptions in different scientific fields. Finally, we recommend to any science teacher to adopt an approach combining the DoV framework and (methodological) preconceptions as a tool to better understand, evaluate, target and overcome students' learning difficulties.

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A STEM Model Encouraging Post-Baccalaureate Pathways for First Generation, Underrepresented Undergraduates

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Abstract

The University of Houston-Downtown supports a STEM program, Scholars Academy (SA) within the College of Sciences and Technology dedicated to enhancing, preparing, and enlightening minority, underrepresented, and first-generation majors seeking entrance into workforce, graduate, and professional programs of preparation. Over the past 18 years the University of Houston-Downtown Scholars Academy has implemented a series of success components supporting the nurturance of post-baccalaureate graduate and professional pursuit yielding a 51% acceptance rate into medical school, over 68 professional degrees (ranging from MD to DO to DDS and DPharm) earned by alumni, over 20 PhD degrees, and over 900 minority/underrepresented undergraduates moving into professional/graduate fields. Briefly, STEM success components consist of 1) Freshman Ramp Up support; 2) Academic Skill Monitoring; 3) Mentoring, peer to peer and PhD to undergraduate; 4) Career and Research Skill Development support; and finally 5) Leadership Development through Community Engagement support.

Keywords: undergraduate mentoring; research mentoring; facilitating beyond undergraduate graduation; facilitating post-baccalaureate clinical/medical degrees.

1. Introduction

Why is a topic related to undergraduate pathways important to an international audience? Like all industries within the U.S. and many outside of the U.S., the current workforce is undergoing transformations of enormous consequence across the clinical, medical, graduate, and professional science communities of training and practice (Kotkin, 2010; Shrethra & Heisler, 2011; Lerman & Schmidt, nd). Examining how one undergraduate institution approaches the issue of invigorating and nurturing undergraduates to develop confidence and competence to envision themselves a part of the professional, clinical, medical, and workforce career-scape may provide insight to other undergraduate institutions seeking to build pathways to future graduate and professional careers (Lopatti, 2004, 2007).

Based on current demographics that Hispanics are soon to become the major ethnic group in Texas by 2030 (Associated Press, 2004) there is a need for Texas to close the science education gap, recruiting more Hispanic students and other minorities into university STEM degree programs. A clear need exists for more minority undergraduate students across a broad natural sciences, computer and mathematical sciences, and engineering technology degree emphasis to enroll in and complete STEM degrees, thus lessening an educational attainment gap evidenced among minorities. Similar data points can be generated for almost any of the 50 US states in 2018. The ultimate goal of increasing the pipeline of minority students entering into baccalaureate degrees and widening the pathway to include post-baccalaureate advanced degree study is related to the need for familiarity of the college experience, pre-college academic support, academic monitoring, mentoring by STEM faculty and undergraduates already successful in the STEM arena, broadened exposure to graduate and industry experts and opportunities, research and career exposure, and leadership development through STEM arenas.

Minority students continue to dismiss the four-year university out of fear of the unknown prior to entrance. Minorities, particularly minority women, continue to fail-out of first-year barrier STEM courses as a result of no substantive support services, lack of adequate pre-college preparatory coursework, and/or little to no acculturation into the study hours and techniques needed to grasp rigorous STEM topics as presented in first year courses. First generation minority students, in particular, have no historical, familial connections to what the collegiate expectations are for STEM students, thus have the least supportive network available to them once entrance into the STEM degree curriculum begins. Understanding the issue enables solutions to arise. We believe the Scholars Academy program to be one of many solutions which enable the widening of the advanced degree study.

Established in 1999, the Scholars Academy as an academic unit in the College of Sciences and Technology at the University of Houston-Downtown, began with the mission of

assisting science, technology, engineering, and mathematics (STEM) undergraduates to graduation with a STEM degree. Since this initial effort of organization, the SA has graduated over 1000 STEM undergraduates, most of whom are Hispanic and/or minority students. The longitudinal success of the initial effort became solidified by the development of a mentoring structure, but became extraordinary as a structure for supporting mentored research was solidified. This paper outlines the structure and function of creating a mentored research program for freshmen and sophomores. As with other institutions of higher education, mentored research is generally associated with the late junior and senior years and for the top five to ten percent only. UHD attempts to put into place a culture accepting of early career mentored research for freshmen and sophomore undergraduates, thereby offering increased experiential opportunities and exposure to students considering advanced degree study.

UHD is located only twenty minutes by rail to the world reknowned Texas Medical Center, MD Anderson Cancer Center, Baylor College of Medicine, McGovern Medical School UT School of Public Health, and UT Graduate School of Biomedical Sciences all within the fourth largest city in the United States. Only one hour by car finds NASA and the U.S. space program. One can easily gather that partnerships, internships, and research opportunities abound for the UHD undergraduate. These opportunistic collaborative partnerships and strong networking helped created graduate and medical school links for UHD undergraduates in addition to extracurricular exposure to top tier research laboratories, thus enhancing the work of UHD PhDs and their research.

2. The Program Components

The Scholars Academy (SA) is an academically competitive program in UHD's College of Science and Technology (CST) that promotes scholarship and a system of support for student success targeting qualifying STEM undergraduates (approximately 185-200 each semester). SA utilizes an established a multi-point STEM program of support yielding not only student success, but also offers a template for replication. Initially, the multi-point model included: Point 1: Scholarship Support assisting full –time student status; Point 2: Mentoring - PhD faculty and peer mentors; Point 3: Seminar/Field trips as broadening experiences and career enhancement; Point 4: Graduate School/Workforce Preparation in the form of CV and Personal Statement development; and Point 5: Exposure to In-house & External Research/Internship opportunities. The SA program model also includes: Point 6- JUMPSTART Research early summer workshop led by PhD researchers in the first two years of university; Point 7- Pre-College START early fall followed by a core seminar course creating a cohort group; Point 8- Research dissemination support; Point 9- Mentor (FM/PM) Training; and Point 10- GRE preparation workshops and access to online practice materials.

An historical examination of five program components as delivered by the Scholars Academy will outline how this program supports advancement into graduate clinical and medical science success. Anecdotal information will provide qualitative insight into building pathways to advanced degrees in clinical, research, and medical areas. Later, with the award of several grant awards the multi-point program activities became condensed into five major categories supporting STEM undergraduates. Table 1 outlines the details of each category of support.

Table 1. Major Categories of Undergraduate STEM Support Creating a Pathway to Advanced Degree Study.

Mentoring	Discipline-based Small Learning Communities
	Led by PhD Faculty Mentor
	Led by Trained Peer Mentor (upper division)
	Networking Meetings monthly per semester (consist of CV/resume/Personal Statement development; academic progress review; study sessions)
	Community Engagement Service Project (one per semester)
Career and Research Skill Development	Scholarly Seminar attendance (career enhancement)
	Broadening Field Trips (career enhancement)
	Mentored Research On Campus with PhD-Early Career (freshman/sophomore)
	Mentored Research On Campus with PhD (-Late Career (junior/senior)
	Mentored Research Off Campus with PhD (academic semester or summer)
	Internal University Research Conference; Nat'l Conferences

Of these multiple points of influence, anecdotal and quantitative data suggests mentored research experiences hold the major impact for any undergraduate, but particularly minorities to develop confidence, competence, and insight needed to entertain an advanced graduate or professional degree of study.

3. The Infrastructure

Using discipline-based groups small learning communities (SLCs) are formed to make up the Scholars Academy. The mentoring infrastructure is formed by 18 smaller learning communities representing the natural science, the computer science and engineering

technology, and mathematics and statistics disciplines. The 18 small learning communities represent the largest number ever of SLCs. The SA mentoring communities did not become established in support of SA STEM undergraduates until the year 2000. With the evolution of SLCs a faculty member was employed as the peer mentor coordinator. This role was established to oversee the upper division peer mentor undergraduates selected and trained to assist the discipline-based faculty mentors. As the size of selected STEM undergraduates increased so too did the infrastructure of the mentoring groups (See the 2016 structure of mentoring image in Figure 1. Mentoring groups (SLCs) focus upon maintaining a limit on the number of mentees within the group. Ideal group membership numbers are evidenced to be between 10-12 members per mentoring group.

Fall 2015 UHD Scholars Academy Organizational Chart

Scholars Academy Executive Director — Mary Jo Parker, Ed.D.

Program Manager — Rene Garcia, B.S.
Admin. Assistant II — Vernon Gonzalez, B.B.A.

SA Ad Hoc Executive Committee: CST Dean, CST Assoc./Asst. Dean, CSET Chair, MS Chair, NS Chair, SA Director

Peer Mentor Coordinator — Mitsue Nakamura, M.S.
Senior Peer Mentor — Westley Wrightson CIET

Natural Sciences (NS)

Computer Science & Engineering Technology (CSET)

Peer Mentor Kiara Arroyo BIOL	Peer Mentor Ilirjani Hyseni BIOL	Peer Mentor Evelyn Valdez BIOL	Peer Mentor Ryan Cherian BIOL	Peer Mentor Esmeralda Martinez CHE	Peer Mentor Robert Jackson CS	Peer Mentor Isreal Cervantes CS	Peer Mentor Glaubyne Viani CIET / Isaias Gonzalez CIET
Asma Aziz Biol	Nuru Bure Biol	Masako Hino Che	Rafael de la Flor Che	Viktor Akhanov Biol	David Alquicira CS	Ngan Do CS	Jesse Gilmore CIET
Mahesh Basyal Biol	Katherine Freeman Biol	Nguyen Luu Che	Milo Falconi-Cacada Che	Zakariya Mahmod Biol	Deepika Dhadral CS	Jonathan Garza CS	Ivan Gomez CIET
Shanna Daniel Biol	Ana Guerrero BPS	James McHenry Che	Gerardo Garcia Che	Kenny Nguyen Biol	Quintin Jackson CS	Robert Jackson CS	Jennifer Herrera CIET
Ashlyn Holbert Biol	William Paz Biol	Benjamin Pilgrim Che	Jose Gonzalez Che	Jacqueline Rocha Biol	Liang Lin CS	Andreea Jula CS	Selam Nabulsi SAD
Alice Solomon Biol	Linda Rubio BPS	Vanessa Cabrera Chem	Lisa Martinez Che	Leticia Villalobos Biol	Tayler Locklear CS	Harit Shah CS	Pedro Padron SAD
Princy Thomas Biol	Sara Valliani Biol	Anh Pham Chem	Karina Torres Che	Yuleisy Contreras Chem	Jonathan Martin CS	Sishir Subedi CS	Graham Wilson CIET
Ana Maldonado Biol	Richard Wrangpetch BPS	Anh Duong Chem	Denisse Velazquez Che	Minh Van Chem	Raul Rios CS	Illiana Barrera CS	Vicente Rodriguiz CIET
Manuel Reyes-Leon Biol	Daniel Khan Biol	Nikki Nguyen Che	Kelsey Ballard Chem	Jared Carroll Biol	Rudy Santos CS	Isaac Suniga CS	Caroline Castro CIET
Amanuel Wonbera Biol	Dania Hasan Biol	Boranai Tychhon Chem			Patrick Taveechai Biol	Adam White CS	Nicholas Marks Safety
Ariel Cruz Biol	Ariel Cruz Biol				Yuntian Zhang CS	Sumit Rawat CS	Roberto Miranda CIET
Jodel Patino BPS	Jeni Braziel Biol				Hira Ayaz CS	Juan DeLa Cruz CS	Kendall Wilkinson CIET
					Alex Luu CS	Jay-Ar Haro CS	
					Abigail Parra CS		Wymond Chan CIET
					Dana Rancifer CS		Anthony Galvan Engr
					Aztea Stevenson CS		Jose Gonzalez CIET
					Carla Gonzalez CS		Anish Khatiwada CIET
							Carlos Montes Engr
							Scott Patterson CS
							Charles Punnathara CIET
							Shushil Shah CIET
Faculty Mentor Dr. Baird	Faculty Mentor Dr. Aoki	Faculty Mentor Dr. Benavides	Faculty Mentor Dr. Jiang	Faculty Mentor Dr. Jose	Faculty Mentor Dr. Shastri	Faculty Mentor Dr. Lin	

(Gladyne/Feng; Isaias/Txouanis)

Natural Sciences (NS)

Figure 1. Scholars Academy organizational chart of discipline-based small learning communities.

Faculty mentors and peer mentors constitute the final pieces of the SLC infrastructure. The faculty mentor represents the expert near-peer (Ingebretson, A., Sjoberg, L., and Larson, S., 2014; Tenebaum, L., Anderson, M., Jett, M., and Yourick, D, 2014) relationship builder. Another leader of each SLC is the peer mentor representing the peer-to-peer relationship builder. Planned opportunities for faculty and peer mentors interactions occur throughout the semester on a monthly basis. These interactions target cognitive and non-cognitive learning such as personal skill development, social supports, formation of study groups, sharing notes and experiences about classes targeting academic strategies, thus giving purpose to the planned monthly network meetings. Most influential are the opportunities for role modeling successes across more than academics, such as career, gender, and ethnicity (Jacobi, 1991). Key to the infrastructure of mentoring is a student leader of peer mentors and a faculty leader over the peer mentors. Selected peer mentors meet monthly with the leadership to revisit common missteps, celebrate full participation in SLC activities, and share hints among the peer mentors that worked within their SLC so that these might be integrated into other groups. The Peer Mentor Coordinator takes on the role of supervisor and trainer, thereby maintaining the peer-to-peer role of the peer mentor. Of utmost

importance is ensuring the peer mentors do not take on judgmental or supervisory roles within their groups or the peer-to-peer trust is likely lost. Peer mentors must be seen as peers to each SLC member, one who is taking also courses but through their own personal experiences in college is someone who can be trusted as SLC members seek advice, information, collegial friendship, and connections.

3.1. Role of the Mentors

The role of faculty mentors and peer mentors differ only in objectives. Faculty mentors aim to guide undergraduates in the development of cognitive and non-cognitive skillsets. Some of the skillsets include: 1) building academic skills, facilitate their success by inquiry (verbal-How are you doing in your courses; non-verbal- Noticing lack of attendance to courses, SLC meetings, and attitudinal changes in general) and 2) reward dedicated efforts and anticipated potential by inviting them to join research labs currently or in the future. Faculty mentors actively support relationship building activities through listening to the undergraduates, making time to meet with them, and suggesting their attendance to a seminar or study session. Peer mentors also aim to guide peer undergraduates, but rely heavily on social, behavioral, and recreational activities and supports to build relationships with SLC undergraduates. They do realize the role includes giving advice, being a trustworthy shoulder to lean on, and role modeling success which is especially impactful for minority and first generation undergraduates (Pita, Ramirez, Joacin, Prentice, & Clarke, 2013). These faculty members agreed in 1999 to participate in the Scholars Academy program as mentors of peer groups and research mentors for no reimbursement, but rather for the good of the students they served. By this time in 1999, research data was abounding indicating that minority and underrepresented undergraduates were not performing as well as non-minority counterparts, nor completing science, technology, engineering, and mathematics (STEM) degrees (Dennis, Phinney, & Chuateco, 2005; Freeman, 2009;). This was the beginning of the Scholars Academy, initiated by faculty who understood the importance of mentored research as a vehicle to understanding what a clinical or medical terminal degree of study could look like and knew how to open doors of accessibility for these undergraduates.

3.2. Broadening Experiences Influential to Career Pathways

The need for enhancement and broadened understanding of careers in STEM is a critical component to finding the pathway to advanced clinical and medical pathways for the first generation undergraduate. Because no familial background exists of the myriad of careers across STEM for the first generation undergraduate and the minority student except for medical doctors and perhaps dentists as a result of familial visits, providing enhanced field trips to graduate schools and medical programs must occur to open their eyes to the world of STEM. Further, scholarly seminars by renowned scholars, practitioners and by SA

Alumni who have completed their terminal PhDs and MDs makes such a profound difference for these undergraduates. They see "themselves" in the successful alumni brought back due to "share their story"! SA Alumni are invited to present at the Student Research Conference.

3.3. Creating Important Traditions

Student Research Conference – An Internal Demonstration of Research - This return of successful (and terminally complete) alumni began in year three of the Scholars Academy organization. It was not until year seven that several alumni members had actually completed medical and/or clinical degrees. This began the tradition of keynote speakers as a major part of the spring student research conference! The tradition continues today in 2018 with an expansive cast of clinical and medical professionals forming the selection pool. Table 2 outline the tremendous pathways which has been built and which continue to benefit the emerging undergraduates as they enter the pathway. Establishing the Graduate School and Internship Fair – Bringing Partners to the Table - In the second year of the Scholars Academy an opportunity to invite current and potentially future partners to the UHD campus was implemented. Originally the focal partners consisted of graduate and professional schools from the Texas Medical Center, other tier-one institutions producing doctoral degrees, and nationally well-known institutions educating medical, doctoral, pharmacy, veterinarian, nursing, and dental terminal degrees. This event actually supported mutually beneficial goals. Goal one focused on these institutions having access to underrepresented high-performing undergraduates for the purposes of recruitment to their post-baccalaureate institutions, recruitment to internship/summer research programs funded within labs at these institutions, and promoting face-to-face interactions of recruitment officers with undergraduates in one locale with a guaranteed audience of approximately 200 or more. Goal two found the undergraduates being trained to interact with graduate and industry recruitment representatives, improvement in professional dress codes and behavior associated with graduate and industry representatives, and allowing the undergraduates to have first opportunities with many summer or academic research opportunities. Key Federal Grant Awards Supporting Mentored Research - The UHD Scholars Academy has a stellar record of ongoing federal and other awarded grant projects. Some $15 million were written and awarded in the first ten years, including the Army Research Office, Minority Access to Research Communities, and the Department of Education Minority Serving Engineering Improvement Program. These funded programs contained elements of the SA success components in particular partnerships with graduate or medical center research laboratory research opportunities with stipend support. During the second decade of the SA, over $10 million continued the earlier initiated mentored research opportunities. However, after the first five years, partners began requesting SA administration to support their federal grant proposals which would utilize the successes of the academic unit as well as

include support for underrepresented undergraduates which assisted in providing additional opportunities for SA undergraduates. Mentored research, funded or unfunded, assisted a culture of looking beyond the bachelor's degree to the next step or to enter into a graduate or professional terminal degree (Lopatto, 2004; 2007). When undergraduates hear, see, and have the opportunity to interact with others like themselves about how each achieved their successes, they begin to envision the possibilities for themselves as a collective and as individuals (Refer to Table 2.).

Table 2. Recent Data Depicting Increases in Entrance into Advanced

Education Pathways – 2015-2018.

Time Period	PhDs	MD	PA/Pharm/ DDS/DVM
1999 – 2018 (18 years)	60	64	28
2015 – 2018 (3 years)	22	22	
2017-2018 (15-months)	8	3	

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The alumni narrative of the connection between university skills and knowledge, and industry: An 'outside-in' understanding

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Abstract

This study takes an 'outside-in' approach by exploring the narratives of university alumni working in industry. The aim of the study is to understand how engaging with industry alumni supports and informs graduate skills and knowledge needed for future employability, and university career/future focused curriculum design. To achieve the aim, the study adopted an Appreciative Inquiry approach to guide a series of n=8 depth interviews recorded in a digital video format. This approach provided alumni with a platform to construct their unique professional narratives in a manner that was relatable and engaging to students, and that universities could use as an educational tool. Data from the interviews resulted in three main themes: 1) the necessity of soft-skills and work experience, 2) the importance of resilience, and 3) the willingness to constantly learn. Theoretically, the findings contribute externally validated support and extension of important and desirable graduate attributes, providing evidence for informing and extending career/future focused curriculum design. Practically, the findings provide students and universities with professional confirmation and foresight of the skills and knowledge needed to transition and navigate the professional workforce, along with an educational tool to implement into curriculum.

Keywords: Employability, alumni, Appreciative Inquiry, graduate skills, industry, curriculum

1. Introduction

Higher Education (HE) comprises a key industry in economies around the world. In Australia, the context of this study, HE is a $32.8 billion industry (IBISWorld 2018). Universities are facing increased pressure to grow their economic footprint (Uncles 2018). This pressure has resulted in increased competition among universities to differentiate themselves to potential student-customers and demonstrate their impact to public stakeholders (Uncles 2018). Enhancing graduate employability is one-way universities are responding to student and public needs, and government metrics. Formal curriculum design incorporating 'real world', practice-based experiences via practicum placements, work integrated learning (WIL) and internships programs, along with extra-curricular opportunities (e.g. mentor programs, ambassador roles), are now commonplace throughout degree programs. It is through these experiences, alongside course work, where students are thought to develop employability skills and knowledge.

While the body of work on employability is burgeoning, few studies have focused on the impact of engaging alumni to better understand employability. Guided by components of Bridgstock's (2017) employability framework, this study uses Appreciative Inquiry (AI) to take an 'outside-in' approach to engage with the professional narrative of industry alumni. This provides alumni with the opportunity to communicate stories illustrating the value of the skills, knowledge and attributes developed during and after their university degree and into their professional experience. In doing so, the channel of communication regarding employability is re-routed from the institution expressing the importance of graduate skills, attributes and knowledge, to relatable, credible industry alumni confirming their importance via lived professional experiences.

2. Background Literature

The positive impact from engaging industry in curriculum design is well-known (Plewa *et al.*, 2015). Multilevel analyses show institutions' connections with professional organizations positively affect graduate employment (Akkerman & Torenvlied, 2013). These connections may emerge from several initiatives such as WIL, internship programs and other work experiences, leading to skill and knowledge development essential for future employment.

For instance, WIL and internship curriculum-based programs have been well documented in helping students develop clear expectations of industry work, soft-skill development, networking and building students' general confidence (Elijido & Kloot, 2015; Drewery *et al.*, 2016; Jackson, 2017). Along with studying specific outcomes of curriculum-based experiences (i.e. WIL, internships), other research focusing on completing HE degrees and participating in extra-curricular initiatives also demonstrates similar skills and knowledge outcomes contributing to employability (see Andrews & Higson, 2014). Initiatives such as

student ambassador and mentor programs have been shown to enhance leadership, communication, teamwork, open-mindedness, self-confidence, networking, industry insight, and help facilitate easier transitions into professional work (Smith-Ruig, 2014; Gannon *et al.*, 2018). Other work suggests students completing university degree programs helped students develop stronger interpersonal, communication and cooperative teamwork skills necessary for employability (Hartley *et al.*, 2018). Existing work provides consistent evidence on the skills and knowledge that contribute to employability as supported by specific curriculum and extra-curricular initiatives and general HE degree programs.

While some existing work incorporates external industry perspectives, a higher proportion of the work is from the student viewpoint, indicating an opportunity to advance the industry perspective. Specifically, little research, focuses on sharing the narratives and experiences of industry alumni to engage with students from the same institution. Some exceptions include Barnard and Rensleigh (2008), who examined information sharing among alumni, and Warren *et al.* (2016), who explored the benefits of interviewing alumni. Indeed, engaging with alumni has the potential to create a stronger, more tangible understanding of employability and connection to industry due to the relatability of studying at the same institution and that alumni represent the notion of success after graduation (Gallo, 2018). This existing work reflects the opportunity of engaging with alumni as mechanism to broaden the scope of understanding employability to include the development of social capital and individual behaviours as suggested by Clarke (2018).

Focusing on the latter opportunity, this study is guided by Bridgstock's (2017) Graduate Employability 2.0 framework. Bridgstock (2017) developed a framework supporting graduate employability through *connectedness learning*. Bridgstock (2017) suggests external relationships and professional networks are key, serving to maximise graduate employability and enhance the relevance of HE curriculum through better industry alignment at three connectedness learning levels: *capabilities*, *pedagogies* and *strategies*. Using a digital video format to explore alumni narratives of transitioning from university to industry and their continued professional advancement, this study aligns with a component from each level of Bridstock's model: *growing connections*; *alumni engagement*; and *use of connectedness enabling digital tools and infrastructure*. It supports the exploration of the following research question: What skills and knowledge do alumni develop during their university and industry experiences that are important for current students as they prepare to transition into the professional workforce and navigate future career paths?

3. Method

Given the exploratory nature of the study, a qualitative methodology using depth interviews was appropriate. The depth interviews were guided using an Appreciative Inquiry (AI)

approach. Briefly, AI is a reflective process focused on understanding the reality of how organizational change is impacted by what currently works and is of value, what might and should be, and what future innovations may be (Hammond, 2013). AI in educational research is suggested when aiming to gain new perspectives, avoiding stereotypical answers, identifying areas of good practice and new ways forward, and capturing the voices of young people (Shuayb *et al.*, 2009), fitting this research. Using an AI approach is also point of differentiation from existing work, adding a level of tangibility to the professional narratives of alumni, allowing current students to engage with the, "strengths, possibilities and successes" (Stavros *et al.*, 2015, p. 97) ─ illustrating how their degree is preparing them for industry transition and career progression. Eight depth interviews lasting between 30 minutes and one hour were conducted at a regional university campus or via Skype. Respondents had to meet the following criteria: 1) alumni of the university, and 2) working in industry for a minimum of three years. An AI interview protocol, informed by the extant literature, was designed so respondents constructed authentic narratives. Data underwent manual thematic analysis. Common themes were identified and were grouped, enabling an understanding of emergent patterns and attributing meaning to the data (Saldana, 2015).

4. Findings and Discussion

The findings and discussion are organized by the themes that emerged, with the final section outlining connections to Bridgstock's (2017) framework.

4.1. Theme 1 – Soft-skills and work experience

In relation to AI, soft-skills were seen of value to alumni during their university experience (Hammond, 2013). Findings demonstrate general alignment with extant literature in terms of soft-skills. All respondents reflected on experiences where they realized how much their degree helped them develop the soft-skills to prepare them for employment. People skills were one type of soft-skill mentioned consistently in respondents' narratives. As an environmental science respondent working in business said, "Some of the specific things I learned was people skills, learning how to do deal with different types of people. I guess it all comes down to how you learn from and work with different people." Another respondent working in marketing and PR stated, "I have now come to appreciate the soft-skills that I picked up during my four years studying…those people skills… 99% of my job is group work." Problem solving was another skill respondents reflected upon as a business graduate mentioned, "The processes I learned in university for completing assignments I apply to everything I'm doing now…If it's applying for a new job…I research the company, do up my proposal, my CV, refine it and ask questions to others working there or in forums." These findings indicate consistency with what has been found in the literature (e.g. Hartley *et al.*, 2018; Smith-Ruig, 2014; Gannon *et al.*, 2018).

Further, a more nuanced perspective of soft-skills emerges through AI narratives. In their reflections, respondents indicated the soft-skills they learned in university are not used in silos, but together. For instance, reflecting on skills developed at university, a business degree respondent provided an example of being emotionally intelligent to communicate with people and solve problems, "It was my second week…suddenly an email was directed at me from a very senior executive, with numerous other staff copied in, with a very blunt statement saying I hadn't delivered this and where was that? So, I thought about it, discussed it with my manager and just stuck with a very factual response…that taught me a valuable lesson not to get emotive on email and to talk with my team." These findings demonstrate soft-skills learned at university are not always apparent until students gain professional experience and reflect on their narratives to appreciate the value of the skills developed while studying.

Work experience was valuable for alumni during their university degree, something that all universities should encourage and make essential for transitioning into future professional environments. This aligns well with what AI aims to understand as would should be (Hammond, 2013). As a marketing degree respondent expressed, "The thing I wish I was told as a student is the importance of work experience. I think every student should have this opportunity during their degree…That's the advice I would give, get in there and work with businesses to find out what they need." An arts and business degree respondent strongly advocated for volunteering to gain experience, stating, "An opportunity came up to volunteer in South Africa during a study break…it was so far beyond anything that I had done in terms of traditional work experience behind a computer…it made all the difference to my professional skills at work because I was able to write about what was involved with it because of having experienced it." While there was mention of structured, curriculum-based WIL and placement experiences within the literature (e.g. Elijido & Kloot, 2015; Drewery *et al.*, 2016; Jackson, 2017), findings indicated any type of work experience, including volunteering, was key in preparing to transition to professional work.

4.2. Theme 2 – Resilience

More of a developed trait than a skill, resilience was mentioned by all respondents as important to transitioning into industry, and a trait all students should develop. An occupational therapy respondent stated, "You kind of hand in your last assignment and wonder what do I do now?...Where do I fit and what can I do with my degree…it's hard to get the exact job you want…but you just got to pull up your socks, and dig, and take the job that will allow you to get experience." A business degree respondent noted the importance of resilience when going through the corporate interview process, "It took 3-5 interviews over 3-4 months, with different companies. Sometimes I would get to the very end and not get it, but I continued to persevere by asking questions."

These findings illustrate the importance of resilience as an element of employability, particularly as students transition from studying into professional work. In relation to AI, students should be aware that resilience building experiences are part of the professional transition and career progression. Universities should consider how they can understand and contribute to developing resilience in students preparing them for the future work world. In some contrast, the findings may also imply resilience is difficult to learn in university. Instead, it is built through experiences, albeit these may start during university. Nevertheless, there is an opportunity for future research on resilience in HE, as most studies are based in the HRM context.

4.3. Theme 3 – Desire to constantly learn, adapt and evolve

Once respondents had successfully transitioned into professional work from university, all noted the salience to constantly learn, adapt and evolve to develop a broad knowledge base.

A journalism degree respondent noted, "My job now didn't exist when I was at uni…you have to be multi-skilled now because of fast paced change in industry. There was a lot of work outside of hours learning…anything you can think to gain experience." Similarly, an environmental science respondent describes his account of starting an environmental consulting business, "The business side of things was a total different kettle of fish I had to learn about. I went back to study and did a small business certificate four…it was continual development for me…that's what it's all about." Through AI, these findings highlight not only the future need to constantly learn, adapt and evolve, but notable points regarding how this can be achieved. It suggests students need to prepare for future work (which may not yet exist!) and career progression. Students should also be expected to develop new skills in their own time, either via additional study or volunteering to take on opportunities outside of their designated job role. Similar to developing resilience, university degrees equip students with the tools to learn, but the need to continually learn, adapt and evolve may not always be realized until students become professionals. As such, it is suggested universities consider drawing on broader employability dimensions to complement the current human capital approach underpinned by tangible skill development and embedded curriculum elements (i.e. WIL and internships) (Clarke, 2018).

4.4. Connection to Bridgstock's (2017) framework

The findings in this study highlight the importance of students developing soft-skills and work experience, resilience, and the desire to learn constantly. These findings can be used to support, inform and extend graduate skill/attributes and career/future focused curriculum. More specifically, in terms of Bridgstock's (2017) framework, they reflect the value of growing connections, through networking and professional networks, and including greater alumni engagement through degree programs, such as guest lectures, mentoring programs

and online via digital content. This can help to avoid the "I wish I knew" moments experienced in employment as outlined by respondents. Further, the dissemination of the findings, via digital clips available online, is aligned with the importance of connectedness enabling digital tools and creates opportunities for consistent interaction as suggested by Bennet and Kane (2009).

5. Limitations, future research and conclusions

This study adopted an Appreciative Inquiry approach to guide a series of depth interviews exploring the narratives of university alumni working in industry. Theoretically, the findings contribute externally validated support and extension of important and desirable graduate attributes, providing evidence for informing career/future focused curriculum design. The findings also offer evidence supporting components of Bridgstock's (2017) theoretical framework. Practically, the findings provide students and universities with professional confirmation and foresight of the skills, attributes and knowledge needed to transition and navigate the professional workforce, and an online educational tool to implement into curriculum. However, there are limitations that require acknowledgement. Importantly, the findings are based on depth interviews with eight alumni at one regional university, limiting their generalizability. This highlights scope for further research in this alumni-reflection space in universities of other sizes, locations, and using quantitative methods.

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Decision Support Systems Aiming in Reducing Globalization Burdens in Education

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Abstract

The potential drawbacks that globalization might have on education are increasing and becoming a main worry. The number of international students is increasing and students' mobility is becoming a crucial phenomenon to obtain a good degree and secure a decent job. Universities have tripled their efforts to recruit and attract international students but their educational ecosystem is still missing some fundamentals. Ensuring that all international students are admitted using an adapted automated admission system, receiving assistance and decent welcome from international faculty and staff, and building their career after are factors that reduce the negative impacts of globalization in education. This paper presents our Decision Support System using knowledge management (KM) approach and AI techniques contributing to achieve those fundamentals and reduce its impacts.

Keywords: *Higher Education; Automated Admission System; International Students; Knowledge Management; Text Mining, and Speech Recognition.*

1. Introduction

Globalization consisting in the integration of markets, cultures, industries and economies around the world (FT, 2019) affects numerous sectors of human life. One of them is education and more precisely higher education. Regardless of the controversial aspects of its influence on countries, developed or developing, positive or negative it can be an important asset in higher education if it is used in an effective method. In fact, nations, regions, country and cities should manage their intellectual capital (Ordonez, Edvinsson (2015).

Globalization phenomena has been risen in the last 20 years due to increasing of internet penetration rate in the world, the easiness and availability of electronic communications (social media, mobile applications, electronic newsletters…) the growth of the low-cost transportation means and the trend for mobility, included into the EU strategy.

Since globalization involves an integration of various cultures then naturally there should be procedures that govern the impact of globalization in higher education to avoid or at least minimize its drawbacks. This paper presents an analysis on how decision support system using knowledge base assessment can help reducing the following weaknesses:

- Selection and admission of international students.
- Services provided for international students to overcome the cultural differences while pursuing their academic programs.
- Success of international programs, not only among international students but also for the international faculty and staff and the absorption of the potential graduates in the desired markets.

This paper discusses these important drawbacks. Also, it contains our analysis of admission process, brief state of the art, presentation of research method, proposed architecture of DSS (Decision Support System) positioned in the context of educational ecosystems.

2. Process of Admission of International Students

With the number of international students increasing globally and the mobility of students is becoming a condition to secure a good job and to gain a shining career, evaluating candidates' prerequisites is becoming challenging (Nguyen, Haddawi, 2007; Bahtiari, 2011). We address this challenge using a methodology based on knowledge management approach powered by adequate AI techniques to help academic institutions in the evaluation of international students' profiles. This methodology should provide multi-criteria evaluation of candidates by considering also their cultural background.

Today applying to any degree seeking program anywhere in the world nationally or abroad requires that candidates should undergo an admission procedure to assess the profile of candidates and to take the final decision (admission/refusal of candidates). Admission systems vary from one country to another and from one institution to another. The whole process is mainly done manually by specialized persons (Min Edu, 2019; Szymankiewicz, 2005) and we did not find any information about a fully automated admission system. The characteristics of each country and institution shape the admission system; most of them require the traditional documentation, evaluation, information: admission and languages proficiency exams, interviews, CVs, transcripts, motivation and recommendations letters. In some countries the first factor of admission is the ability to pay for courses.

An adequate evaluation of students will shorten the gap between the student, the desired country and its educational system. Academic program in any country is designed based on specific cultural aspects and the universal contents of curriculum. Creating an adapted assessment of profiles can predict the eligibility of students to attend an academic program in a multicultural environment.

2.1. Admission Process

All recruiting institutions require the candidate information and exams results to decide its admission status. The general admission procedure can be described as follows:

- Students apply online on the institution website by supplying all requested and relevant documents.
- Admission teams process the files following the order:
    - Relevance of the candidate to the requested major
    - Candidates high school or bachelor grades
    - Candidates experience and skills
    - Interview conduction (remote or face to face) to detect: genuineness, motivation, and capacity
    - Exams conduction to detect knowledge and practice
    - Financial status (mainly Anglo-Saxon institutions)

2.2. Components of Proposed System

As an entry point to understanding the admission system, we consider two major knowledge blocks contributing to the relevant evaluation of students' profiles: Curriculum Vitae (CV) and the online interview. The CV still is an important document that helps the admission committee identifying important information about the candidates and provides knowledge on student's academic and career path. The online interviews help detecting motivation and validate the consistency and genuineness of the candidates' in line with

their CVs and profiles. For this purpose, the online interviews will be recorded and rerun for the offline evaluation.

Curriculum Vitae (CV)

This block is very essential in the evaluation process. In the current systems the CV students are not taken into consideration as the evaluation logic only depends on the profiles of previous students who have succeeded a certain curriculum. Hence it depends on a comparative mechanism that might be valid for students coming from the same background but might fail for a diversified group of students. CV should provide the following information about each candidate:

- Basic: to detect the country of origin of each candidate, age and gender. The country will be a crucial factor in the adapted evaluation since a cultural impact matter here.
- Academic background: to detect the institution attended by the candidate and the highest degree obtained and the number of academic years after high school. This will bring elements for a base of academic institutions worldwide that will be ranked based on students' success after enrollment and pursuing of classes.
- Professional experience: to verify the experience and skills acquired and its relevancy to the degree obtained. This will bring elements for a base of companies worldwide that will be ranked based on students' success after enrollment and pursuing of classes.

Beside the direct knowledge that will be extracted from CVs, text mining will be applied to discover knowledge from the unstructured text by merging all the above listed information.

Online Interview

The online interview will be used to evaluate the English language level of candidates, their motivation, their capability to present themselves and present a coherent project of life, and some easy behavioral aspects. The video interviews will serve to:

- Detect the candidates' oral ability by evaluating the first couple of minutes of their interview.
- Analyze the candidates' behavior in terms of self-confidence and consistency.
- Evaluate the candidates' answers to detect their motivation and relevance.

The integrated system of student's evaluation using knowledge management approach is presented in Figure 1. The main aim is to assess how KM can help in such system. By presenting and analyzing the 2 major components of the evaluation system, we will be able to obtain an architecture that leads to an adequate evaluation of candidates. Also, this analysis will help us to validate the proposed solution on real cases and integrate feedback.

Such evaluation is beyond the traditional one assessing the experience, the skills acquired and the behavior in a multinational environment.
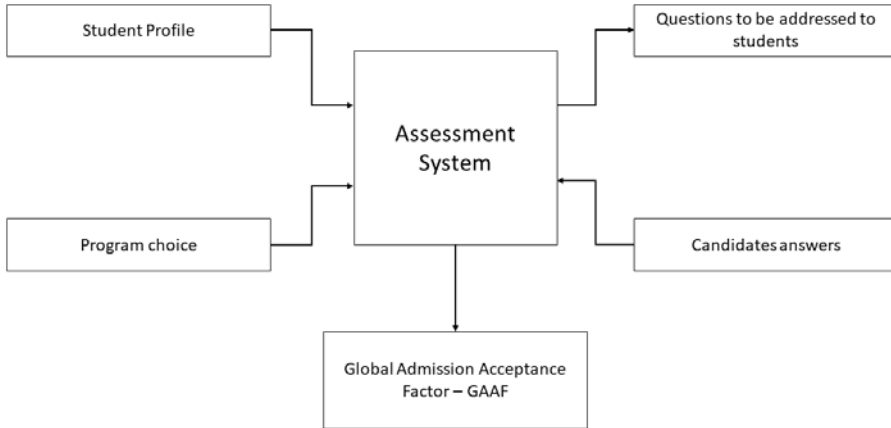
Figure 1. Proposed architecture of decision support system for student admission

This admission system should provide universities with qualified profiles who are adapted to the desired programs and countries and hence reduce the risk of having students integrating international institutions abroad but never managing to validate the academic conditions to get their degree and missing the main objective of coming to these countries.

3. Innovating Educational Ecosystem – added values and benefits

As per the UNDP (United Nation Development Program) by following the 4 learning principles (to live together, to know, to do, and to be) many globalization problems such as meeting current social challenges and acquiring new skills in a fast-moving technological environment can be resolved (UNDP 2019). By using decision support systems that produces educational system in line with the students' profiles the objective of each of these learnings can be achieved.

3.1. Academic Adaptation

Learning to live together

Based on historical information and students' knowledge and intelligent algorithms, this system can provide an adequate environment to the student to work their projects together

and interact positively. The workgroups can be generated based on cultural complementarities. Also, system can provide professors with conflict resolution practices based on the students' background or culture.

Learning to know

The decision support system can provide students with many success stories that have been implemented in the sector of the activity related to the student specialization. Those stories can have a dual task. First by motivating the students to work during their academic program to validate the condition to obtain the degree. Second by forcing the students to think out of the box and innovate while conducting their projects and acquiring experiences.

Learning to do

Learning enough or learning to do enough is not enough. Students should be able to apply the acquired knowledge in complex situations. By using the decision support systems and by analyzing the available information, students can be provided simulators that produce real situation and real-life examples.

Learning to be

The system also should be students centric to detect their soft skills and provide them with an adapted training program to enhance what is needed.

Learning what and how to learn should be added to these four (Mercier-Laurent, 2011).

3.2. Logistic Services

In aim preserving balance of educational ecosystem, in addition to the academic support and adaptation, the welcome services should be provided to overcome the problems that might affect the academic track of students. Also, there should be a strong connection with the real life. This logistics support should include pre-arrival, on arrival and post arrival services to facilitate the integration of students in the desired country and reduce homesickness. The pre-arrival services should include finding accommodation, visa procedures guidance, organizing the airport pickups. On arrival is to make sure students are well settled down and have already all the administrative procedures related to the desired country.

Our decision support system includes the base of problem solving that have been addressed with previous batches/countries to learn from the previous experience. A mentorship system based on cultural affinity could be produced to assure the different groups of students coming from different cultures (Bakhtiari, 2011). Also, events should be organized to help the international student meet national students to exchange experiences at the

language level, academic level, political level and cultural level as well. Such type of communication can diminish international student strains and help national student accept and understand the behavior of international students.

By applying those best practices, the number of international students in any country will grow and the possibility of having more comfortable international environment will be higher. This will reduce directly the risks and drawbacks that might be produced to globalization in education.

4. Elements of Success of International Programs

Ecosystem of Students, Environment & Staff

The designed academic programs that are proposed to international students should be attractive and motivating not only for the students but also for the faculty members who are teaching the programs (Zhou 2018). When a student is seeking a degree in a certain country, the aim is to peruse a degree with an international staff and in an international environment and not only national. This is richer and more beneficial to international students.

The admission system described in section 2 can be used to recruit faculty members as well. The main objective is to have international staff able to adapt the teaching method to the students needs. The faculty members should focus on the success of international students in the desired country and program. By using this approach, we can solve of one the important problems, retaining the maximum number of international faculty and limit the turnover of good and adequate profiles.

This will have also a positive impact on national students as it helps them to be more open to accept cultural differences and to be more efficient in tackling professional life challenges and managing projects in a global environment. There will be an indirect leverage of national students' skills.

Market absorption

Many countries do not manage their intellectual assets, neither they do not have a talents management system. A very dangerous burden of globalization in education is when the economy of the desired country is not able to absorb the potential graduates. The objective is to shorten the distance between the fresh graduates and the recruiters and provide the adequate profiles to the market. This is a result of using an adapted approach with international students. It starts by providing an adapted curriculum lectured by international faculty members and working closely with companies. Also, offering local language

courses throughout the whole academic program will help the students' integration easily the professional environment and valorize their degree obtained.

5. Conclusion and Future Work

Decision Support Systems described above helps recruiting motivated students and reducing risks incurred by globalization. It covers three main areas: admission of international students, the balance of educational ecosystem and success of educational program. Apparently, the provided analysis and proposed systems can help in reducing failure in the pursued programs and can reduce the unemployment of students seeking careers abroad, all of that in an acceptable and comfortable environment.

The Future work includes integration of components and testing on hundreds of students' applications to verify their outputs and validate the proposed algorithm. In fine we would like to connect this system with the Intellectual Capital Management in aim of planning the resource for the future, especially in IT field moving very quickly.

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German Universities as Actors in Organizational Design – A Qualitative Study

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Abstract

After the latest reforms in higher education according to the NPM (New Public Management), the autonomy of universities and the organizational perspective have been strengthened. According to predominantly used neo-institutional research in higher education, organizations adapt their structure by the pressure of legitimacy from outside. So the research question arises if universities are actors and if so, what are the influencing factors on organizational structure. The goal is to point out the reasons for organizational design and if they act on their own or only adapt changes by pressure from outside. For this, interviews with 16 experts in faculty management are conducted and interpreted using qualitative content analysis according to Mayring and Grounded Theory.

The results show that it is possible for faculties to change and design their organizational structures. There is staff responsible for this task. They work in the faculty between management and administration. Reasons to change the organizational structure are not caused by legitimacy. Much more, the new tasks cause a real need for new positions. This argumentation is not in line with neo-institutionalism. So the results strengthen the thesis that neo-institutionalism is not sufficient anymore to explain the organizational change of universities.

Keywords: Higher education organization; new public management; organizational design; qualitative research; neo-institutionalism.

1. Introduction

Reforms in higher education according to the NPM and Bologna have caused profound organizational changes. They emphasize the increasing economic rationality of the university (Christensen, 2011). The autonomy of higher education institutions has been strengthened in most higher education systems. They are seen more and more as service companies and less as cultural institutions (Braun & Merrien, 1999; Hüther & Krücken, 2018, p. 135). Universities are intended to develop to complete organizations, which means that they have an identity, a hierarchical organization, in which the leadership has decision-making power, and rationality, which means effective and efficient acting (Brunsson & Sahlin-Andersson, 2000).

Until now, higher education research has often used sociological neo-institutionalism to analyze the in-depth changes (Krücken & Röbken, 2009). According to neo-institutional research, organizations adapt their structure by pressure from outside (isomorphism caused by legitimacy). The organizational structure is defined as the system of rules to adjust the behavior of the members of the organization to a specific superordinate goal (Frese, 1992, pp. 1670-1671). The organizational design focuses on adapting the existing organizational structure to changing requirements (Scherm & Pietsch, 2007, p. 128).

The problem area of neo-institutionalist theory is the exclusion of the actor and his interests and strategic actions (Walgenbach & Meyer, 2008, pp. 115-116). It is questioned that the idea of neo-institutionalism is still useful for recent research about higher education organization. From this, the research question arises if universities are actors and if so, what are the influencing factors on organizational structure. So, the goal of this paper is to point out the causes for organizational design, which can be interpreted here as agility drivers, and if they act on their own or only adapt changes by pressure from outside. Agility drivers mean here the ability responding to changes as described in chapter 2. For this purpose, first, a brief overview of NPM and actorhood is given as well as an overview of neo-institutionalism in higher education research. Then, the research procedure of conducting interviews with experts and analyzing them using methods of qualitative research as grounded theory and qualitative content analysis according to Mayring is described. The results are presented, discussed with alignment into current research, and a conclusion is drawn.

2. NPM, actorhood, and neo-institutionalism in higher education research

In the following, the connections between the NPM and universities as organizations from higher education research are outlined. Universities are specific bureaucracies, which deviate from the rational-bureaucratic organizational model in some ways: in research, they are considered as loosely coupled systems (Weick, 1976), professional organizations

(Mintzberg, 1983), and organized anarchies (Cohen, March, & Olsen, 1972). These deviations restrict characteristics of bureaucracy as goal attainment, decision rationality, and hierarchical control (Hüther & Krücken, 2018).

So far, neo-institutionalist classics are predominantly used to analyze the profound processes of change in the organization of higher education institutions caused by the NPM (Meyer & Rowan, 1977; March & Sutton, 1997; Delucchi, 2000; Röbken, 2004; Morphew & Hartley, 2006; Meier, 2009; Krücken & Röbken, 2009, p. 327; Blümel, 2016). The main components of neo-institutionalism are isomorphism, which means alignment by the assurance of legitimacy (Krücken & Röbken, 2009). Legitimacy is derived from the environment of the organization through conformity with predominant expectations, which is expressed in the outwardly directed formal structure of the organization. The cause for organizational change and new structures, e. g. by the establishment of positions in faculty management, is therefore not to improve decision-making structures in an effective and efficient way. In earlier publications of neo-institutionalist theory, organizations seem to be passive units that adapt to the expectations of the institutional environment and adopt institutionalized structural elements and management practices (Oliver, 1991; Walgenbach & Meyer, 2008). Interests, strategic actions and the power of actors are excluded (Beckert 1999; Walgenbach, 2014, p. 329). More recent developments, however, cannot longer easily be explained by early neo-institutionalist theories due to increased efficiency expectations, privatization, and accountability obligations (Meyer & Rowan, 2006; Krücken & Röbken, 2009). Recent publications show that the organizational specifics of universities are relativized. Blümel (2016) states that the academic-bureaucratic model of administration is to be replaced by a post-bureaucratic management model. The NPM reforms are seen as an attempt to construct universities as "complete organizations" (Brunsson & Sahlin-Andersson, 2000), which means that universities are aligned with companies. Complete organizations are characterized by the dimensions identity, hierarchy, and rationality. For faculties, this means shifting decision-making authority towards faculty management and e. g. the use of instruments like performance measurement and evaluations. However, this development cannot completely modify organizational peculiarities (Hüther & Krücken, 2018). Complete organizations are called actors following the neo-institutionalist language (Brunsson & Sahlin-Andersson, 2000; Meier, 2009).

The term organizational actorhood has gained prominence in literature about higher education. It describes the basic elements of the change processes with emphasis on organizational accountability, formalization of structures, and focus on goal definition and managerialism (Krücken & Meier, 2006; Meier, 2009; Elken & Røsdal, 2017). With the ability to behave like an actor, also agility comes into focus. Agility is the ability to both create and respond to change in order to profit in a turbulent business environment (Highsmith 2004), which is caused in higher education by increasing competition from

Bologna and NPM. Sharifi and Zhang (2001) suggest that agility conceptually encompasses responding to changes in time, and exploiting and taking advantage of changes as opportunities. So, the causes for change can be interpreted as agility drivers.

3. Method

To gain data about organizational design, interviews with experts are suitable. The advantage of expert interviews is that they provide in-depth insights into the organizational activities of the faculties. Qualitative research is appropriate when little is known about a field of research. It has an explorative character (Vogelsang, Steinhüser, & Hoppe, 2013; Mayring, 2014) and serves a better understanding of the phenomena to be investigated (Döring & Bortz, 2016). Qualitative research is increasingly gaining acceptance because it makes it possible to obtain new insights (Palvia et al., 2004). Additionally, the detection of new categories, the finding of their concrete meaning in the faculty and theory formation as well as hypothesis formation are possible using qualitative research.

For this, sixteen guided interviews were conducted. Initially, thirteen of the sixteen persons were interviewed. After evaluating the results, three further experts were interviewed with unchanged guideline to prove the theoretical saturation (Strübing, 2014). As no further impulses could be gained from the new data, the data set was regarded as useful. Members of faculty management from eight universities and faculties of different disciplines within Germany were selected as experts. They hold positions as deans, heads of institute, faculty or deanery advisors, study course coordinators or managers and therefore have profound knowledge about the organizational activities. In selecting the sample, care was taken to provide diversity regarding the size of the university, the size of the faculties, the disciplines, and the federal states in order to ensure multi-perspective views and to reflect the heterogeneity of the population (Flick, 2016, p. 156). Table 1 and table 2 give information about the job titles and the disciplines of the interviewed experts.

Table 1. Job titles of the interviewees.

Job title	Interview
Study course coordinator	1, 2, 3, 4, 5
Course Planning, Accreditation, Quality Management	13
Head of personnel / organizational development	16
Head of institute	6, 7
Faculty advisor, deanery advisor, manager, director, administration manager	9, 10, 12, 13, 15
Dean	8, 11
Total	16

Source: own research.

Table 2. Disciplines of the interviewees.

Discipline	Interview
Economics, business administration, law	2, 3, 7, 8, 11, 13, 14, 15, 16
Engineering, natural science	4, 9, 10, 12, 16
Humanities, social science	1, 5, 6, 14, 16
Total	16

Source: own research.

The interviews were held with the help of a semi-structured interview guideline, including the following sections: a) Presentation of the interviewee; b) Understanding reasons to change the organizational structure, including questions like: Is there scope for organizational design and to what extent is it used? Which are the reasons to adapt the organizational structure? Can the structure be influenced at all? Is there a person responsible for organizational design in the faculty? The interviews were conducted in German and afterward translated for research purposes. They had a length of 45 minutes to 1:45 hour. Twelve of the sixteen interviews were held in a personal conversation, four by telephone. There are quality criteria for qualitative research from Steinke (1999), Kromrey, Roose, & Strübing (2016), and Strübing et al. (2018) like reliability (Kromrey, Roose, & Strübing, 2016, p. 321), empirical saturation (Strübing et al. 2018, p. 88), and traceability (Steinke, 1999, p. 207; Döring & Bortz, 2016). The interviews were recorded and transcribed to provide intersubjective traceability and documentation (Steinke, 1999, p. 207). Additionally, they were coded in two iterations to provide intra-coder reliability as well as from different researchers to provide inter-coder reliability (Kromrey, Roose, &

Strübing, 2016, p. 321). The length of the interviews and the heterogeneity of the sample ensure empirical saturation (Strübing et al. 2018, p. 88). Further is named the role of the researcher, who should be clearly defined during the research process, so that the subjects are not influenced in their statements (Steinke, 1999, pp. 231-323), and coherence, which means consistency of statements (Steinke, 1999, pp. 241-248). The attribution of the statements proves to be clear. So, important quality criteria of qualitative research are fulfilled. The results can, therefore, be considered relevant to this field of research.

The qualitative content analysis according to Mayring (2015) is appropriate because relevant categories can be identified during the research process. The method of reducing relevant interview statements to categories is thoroughly used. The categories are founded on careful interpretation. The techniques that were provided by Mayring (2014) are combined with the techniques from Grounded Theory. The core of Grounded Theory is to enable the development of theoretical suggestions from the text material (Glaser & Strauss, 1975). Results can be compared with those of other already existing theories after finishing the coding process. As expected in Grounded Theory (Corbin & Strauss, 1990), it was the purpose to act as a neutral observer to receive answers from different perspectives. The results are presented and discussed in the following.

4. Discussion

Two categories from the interviews could be considered relevant. As the first detected category, *agility drivers* could be identified in the form of *more complex tasks and needs*. Reasons for changes in the organizational structure can be interpreted as agility drivers because they foster agility, which is defined as the ability to exploit and respond to changes in time (Sharifi and Zhang, 2001). As the second category, the *existence of an organizational designer* was identified. In the following, both categories are defined and explained using examples from the interview material.

An increasing *amount and complexity of the tasks and needs* are mentioned as *agility drivers* of the organizational structure. One interviewee responsible for personnel and organizational development describes the remit like this: "One of my first activities here was the reorganization of the departments into faculties. Within this framework, new positions such as faculty management were established. These are all jobs that were newly created. With these positions, one tries to establish a long-term management position next to the deans because it was clear that more and more tasks are coming up for the universities, which not only have to do with research and teaching but also with financial questions, science management, evaluation and so on. There, the university needs someone who ensures certain continuity, besides the dean, who changes every two years." (Interview 16) This increased amount of work is caused by more self-administration (Interview 12),

more audits and accreditation obligations. This is caused by law (Interview 2, 16), the size of the faculty measured in number of students (Interview 1), and the structure of students (Interview 3, 12): a large percentage of students with a migrant background or first university graduates in their family cause a large need for advice. It is also highlighted that the Bologna reforms cause more tasks (Interview 4). Students have more demand for advice, but also their expectation attitude has increased. This leads to a higher workload for faculty management and advisory positions (Interview 4, 1). The personality of students in the sense of less independence and autonomy is, therefore, another factor influencing the workload (Interview 6, 1). It is further stated that an adjustment is made in the case of a personnel change due to resources becoming available (Interview 6).

In addition, the interviewed persons confirm that organizational design is possible by an *organizational designer* such as the dean (who fulfils these tasks among many others in his role), managing director or faculty advisor or an employee for personnel and organizational development: "The dean takes care of the current business, and there are also somehow structural questions or administrative matters, with everything that concerns administrative, which I also manage." (Interview 13) A dean illustrates the responsibilities as follows: "The managing director also has a very important position, because, as I said, she is there every day, and she also knows where problems lie with the employees and who actually undertakes what tasks and where there is still potential for new tasks, de facto the organizational design is done by the managing director, but of course, de jure, i.e. legally, I would already have the opportunity to say that I would like to do things differently." (Interview 11) Organizational design is possible by the dean (limited by a short term of office) or new professionals like the managing director or faculty advisors. This points to the university's ability to act and to its status as an actor (Meier, 2009). By implementing management reforms, universities should develop similarities with corporate actors (Braun, 1999, p. 240; Meier, 2009). There is a need to establish new positions caused by more tasks which are provoked by law and reforms (Bologna).

5. Conclusion

Causes for adapting the organizational structure by creating new positions for faculty management are less to be attributed to isomorphism or legitimacy, which would have caused statements in the argumentation like "that is how it is done nowadays, it is modern", than to actual needs. In this respect, the sociological neo-institutionalism cannot explain the reasons. The explanation by the actual needs and more complex tasks rather points to the economic principle. This also shows that the change of higher education organization does not only follow external institutional demands (Levy, 2006), but speaks for a stronger actor-theoretical view (Krücken & Röbken, 2009; Walgenbach, 2014, pp. 329-333). A clear focus on managerialism, hierarchization, formalization of structures, and accountability is visible,

which are characteristics of complete organizations and organizational actorhood (Brunsson & Sahlin-Andersson, 2000; Krücken & Meier, 2006). It is shown that faculties can act in an agile way and, behaving more as complete organizations, respond to agility drivers. It is possible for faculties to change and design their organizational structures by responsible employees. So, additional research could consider more effectiveness and efficiency than legitimacy. It can be assumed that the results differ from country to country because the degree of NPM varies, as research has shown (Lange & Schimank, 2007). NPM is relatively strong e. g. in Great Britain, Australia and the USA. There could be a positive correlation between the development of NPM and organizational actorhood, which may be more pronounced in countries with stronger managerial self-governance. Evaluation in other countries could be an interesting topic for further research.

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Balancing the local and global: A review of teaching and learning literature from Colombia

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Abstract

This paper presents a systematic review of the extent and nature of teaching and learning research in Colombia. The study identified that teaching and learning research is growing but is unevenly spread amongst a small number of Colombian private and public universities. The quantity of learning and teaching research emerging from a small number of institutions is linked to the presence of education development centres that support the research and dissemination of teaching innovation. The dominance of research related to technology innovation reflects the purpose of these centres. The teaching and learning research literature emerging from these universities reflects global educational themes but contains little of the issues and challenges related to diversity, inequality, and other social, political and economic realities that situates higher education research within local contexts. This study concludes that a critical approach to teaching and learning research is needed to balance the local with the global in teaching and learning research in Colombia.

Keywords: SoTL; teaching and learning research; Colombia; higher education; investigación en el aula.

1. Introduction

This paper presents the findings of a literature review that explored the incidence and nature of Scholarship of Teaching and Learning (SoTL) in higher education in Colombia. The study found evidence that while research of teaching and learning processes in Colombia is an increasing field of investigation, the knowledge emerging reflects its positioning as a nation that has been globalised ontologically and epistemologically and which draws extensively on the theories and practices developed in the 'global north' (de Sousa Santos, 2014; Guzmán-Valenzuela, 2017). The findings from this study reflect Colombia´s position as a peripheral nation in a globalised world that has privileged knowledge production and ideas from certain countries while devaluing that from others (de Sousa Santos, 2014; Guzmán-Valenzuela, 2017). The SoTL literature emerging from Colombia reflects global dominant discourses of teaching and learning while revealing little of the contexts in which it has been produced.

Globalisation and its impact on education have been conceptualised in a variety of ways. The Critical Cultural Political Economy of Education (CCPEE) perspective is that education is shaped by different cultural, political and economic structures and that it should be understood within specific contexts (Robertson & Dale, 2015). Education also acts to shape and reproduce these structures. An understanding of education from this viewpoint stimulates questions about the domination of certain knowledges and the subjugation of others.

This paper proposes that application of a CCPEE approach to learning and teaching research in Colombia would enhance its visibility and provide richer, more nuanced, and context-based understandings of education processes. The questions and challenges that arise from the Colombian educational context could then be connected to those in other nations, providing opportunities for local ideas to go global rather than a global agenda imposing specific pedagogies in diverse contexts (de Sousa Santos, 20014). A critical approach to teaching and learning research would make visible 'other' kinds of educational globalisations and create new understandings of the world that embrace its diversity.

2. Background

The literature review shared in this paper is the first stage of a research project conducted by staff members from the Centre for Teaching and Learning at the Universidad de Los Andes (Uniandes) to develop strategies that support the university´s focus on strengthening, integrating and coordinating its teaching and research-creation activities. Uniandes is a private university based in Bogotá, Colombia. Colombia is a pluriethnic and multicultural country with a majority 'mestizo' (mixed ethnicity) and minority indigenous (3.4%) and afro-Colombian (10.6%) populations (Dirección Ministerio de Educación, 2018). As a consequence of its diversity, education in Colombia takes place within rich cultural and linguistic settings that vary significantly between and within regions. A high level of

inequality and a turbulent recent history of violence and corruption are also factors that influence the education landscape. A challenge for the Colombian higher education system is to contextualise teaching and learning within the current social, political and economic reality while forging a strong and competitive education system in a globalised world.

3. Research Design

A systematic literature review was conducted of teaching and learning research in higher education in Colombia. In this review learning and teaching research refers to research conducted by academics of their own pedagogical practice in the higher education sector in Colombia. Theoretical research was excluded from the review.

The literature search was conducted using the library search engines of Uniandes and Charles Darwin University (CDU), Australia, which provided access to 40 and 256 databases respectively. There was some overlap of major databases such as EBSCO, Wiley, ProQuest, Science Direct, Web of Science and SAGE, but the individual collections were significantly different and reflected each university´s geo-political positioning. Searches of the two institutional collections enabled the identification of scholarly literature emerging from English and Spanish language sources in international and regional publications. The literature review also included articles identified in Google Scholar and from a scan of publications listed in the websites of Colombian universities known to have strong interest in pedagogy including Universidad Pedagógica Nacional, Universidad Nacional de Colombia, Universidad del Norte, Universidad de los Andes. This led to the identification of additional journal articles and edited books with a focus on SoTL.

Potential articles were selected from review of abstracts. The texts were then read in full to confirm their inclusion in the study and to identify key themes, methodologies and pedagogies. The search was not date restricted and the review identified literature published between 1999 and 2018. The search terms used were 'Colombia', 'Scholarship of Learning and Teaching', 'SoTL', 'classroom research' and 'higher education' in English, and 'investigación en el aula', innovación en el aula', 'innovación pedagógica' and 'educación superior' in Spanish. A limitation of the study is the narrow focus of these terms given the wide range of themes, disciplines and approaches in teaching and learning research. Specific methodologies such as action research were not included in the search. It is likely that an increase in the search terms and widening the scope to search more university websites and journals published by Colombian universities would reveal a higher incidence of SoTL in higher education in Colombia than reflected by the findings of this review.

4. Findings

4.1. Teaching and learning research is increasing in Colombia

The review identified 83 journal articles and 103 book chapters focusing on teaching and learning research in higher education in Colombia published between 1999 and 2018. Of these articles eight were published between 1999 and 2006, 35 in the six years 2007 to 2012, and 40 articles in the six years 2013 to 2018. This provides far greater evidence of SoTL activity in Colombia than identified in a previous study by Guzmán-Valenzuela (2017), which identified only five SoTL articles from authors affiliated with Colombian universities between 2000 and 2015 in a search of the Web of Science database. Despite the difference in volume of articles identified in the two studies, both show that SoTL is an increasing field of study in higher education in Colombia, as in other Latin American countries.

4.2. There is an unevenness in teaching and learning research in Colombia

Teaching and learning research in Colombia is concentrated in the hands of less than a fifth of the nation's universities. Academic staff affiliated with 34 of Colombia's 189 universities (uniRank, 2019) were responsible for the production of the journal articles identified in this study. Of these 34 universities, staff from two universities produced 29 (33%) of all journal articles: Uniandes produced 15 articles (17%), while Universidad Nacional de Colombia (Universidad Nacional), a public university, produced 14 (16%) of the articles. It is notable that these two universities are highly ranked in the 2019 QS World University Ranking (272 and 275 respectively) and are in the top ten universities in Latin America (QS, 2019). Staff affiliated with just 14 universities produced 77% of the total number of articles, while the remaining 20 universities produced just one article each. Of these articles, 47 (54%) emerged from public universities and 40 (46%) from private universities. Additionally, 103 book chapters were identified in books published by private universities of which 96 were in books published by Universidad del Norte (Uninorte) and seven in books published by Uniandes.

4.3. Institutional support is linked to participation in teaching and learning research

The universities, which produced the majority of the articles and chapters, related to SoTL, Uniandes, Uninorte and Universidad Nacional, have central offices that provide support for the integration of digital technologies into higher education teaching: the Centro para la Excelencia Docente (Uninorte), Conécta-Te (Uniandes) and inTIColombia (Universidad Nacional). Hence, the incorporation of learning technologies with teaching practice is a main theme emerging from Colombian learning and teaching research, with 41% of all SoTL research identified relating to technology integration. The extent and nature of the support provided by these centres is varied. At Uninorte, the support is systematic and focused on publication whereas at Uniandes and Universidad Nacional the support is more individually focused, with publication a positive by-product of support for technology integration.

4.4. Spanish and English are languages of publication in Colombia

While English is the overwhelming language of publication of SoTL journal articles with 70 (84%) of the articles reviewed published in English, in contrast 100% of the book chapters identified were published in Spanish, Colombia´s national language. The literature reflects the strength of Spanish as a language of research dissemination within Colombia along with English, which is regarded as the global language of academic discourse in many disciplines (Cortés & Arellano, 2017). The high number of articles in English reflects the publication by Colombian universities of English language journals, such as *Profile: Issues in Teachers' Professional Development* published by the Universidad Nacional de Colombia and the *Colombian Applied Linguistics Journal* published by the Universidad Distrital Francisco José de Caldas. Other journals such as the *International Journal of Bilingual Education and Bilingualism,* published by Routledge, accept articles in English and in Spanish.

4.5. SoTL is emerging from a range of disciplines

SoTL in Colombia is emerging from a range of disciplines. There is a strong focus on English language teaching, with 69% of the articles relating to English teaching either as a specialised field or in the context of bilingual education or teacher education. The remaining literature is from a range of disciples. Science based disciplines such as medicine (Ankle et al., 2018), pharmacy (Valderrama Sanabria & Castaño Riobueno, 2017), biological sciences (Archila et al., 2018) and engineering (Rosero-Zambrano et al., 2018) were represented in the literature. Other disciplines such as architecture (Navarro Morales & Londoño, 2018), language education (McDougald, 2013; Pineda Hoyos, 2018), social sciences (Lobo, 2017) and business (Zambrano & Guerrero, 2009) are also represented. The disciplines of physics (de Castro & Martínez Gómez (Eds), 2017) and mathematics (Rojas Álvarez et al. (Eds), 2013) are strongly represented in disciplinary-focused edited books emanating from Uninorte.

4.6. Research in teaching and learning reflects global themes and theories

The literature reveals that the methodological approaches to research in the classroom, the theories that these are based on, and the pedagogical practices that are the objects of study reflect global themes and dominant approaches to investigation. Learning technologies were a major theme of research, reflected in 41% of the journal articles, and in the majority of the edited books published by Uninorte. The literature encompassing learning technologies included topics such as the use of flipped classrooms (Navarro Morales & Londoño, 2018), active learning (Lobo, 2017), and problem based learning (Echavarria, 2010). Other pedagogical dilemmas such as teaching large groups of students are also evident in the literature (de Castro & Martínez Gómez (Eds), 2017). There was little evidence in the literature of place-based theories of teaching or learning, or contextually based pedagogies or research practices. Exceptions included a focus on bilingualism, a focus of Colombia

educational policy (Archila et al., 2018), and an article focusing on the learning of indigenous students written by an indigenous author (Cuasilpud Canchala, 2010).

5. Discussion

The literature reviewed in this study indicates that teaching and learning research in higher education in Colombia is increasing and is much stronger than suggested by previous research (Guzmán-Valenzuela, 2017). However, there is an "unevenness of SoTL activities" (De Courcy et al., 2017, p.1) across the higher education sector. The literature reviewed presents a view of teaching and learning research emerging strongly from the most respected public and private educational institutions.

The amount of teaching and learning research taking place in Colombia is clearly linked to the level of institutional support provided to staff members. At Uninorte, Uniandes and Universidad Nacional de Colombia this support is predominantly linked to engagement in technology integration in teaching practice, which is evident in almost half of the research literature reflecting technology related themes.

Although English is regarded as the primary language for dissemination of academic research in many disciplines (Cortés & Arellano, 2017), this study found a significant amount of research from Colombia published in Spanish, particularly in book chapters. This suggests a push back to the status quo of English as 'the' global language, and the positioning of Spanish as a legitimate language for academic discourse. Uninorte´s publications, in particular, reflect a strategy to prioritise the dissemination of pedagogical innovation and research to the Spanish-speaking world despite the pressure faced by academics to publish in high status English language journals in order to enhance their international profile and career prospects.

The themes, theories, pedagogies and methodologies utilised across the literature were drawn primarily from western research orientations. This reflects a globalisation of education that privileges dominant global discourses of education over local knowledges. The literature reviewed "does not take into consideration the complexity and richness of teaching and learning in specific contexts" (Guzmán-Valenzuela, 2017, p.5). While global themes are important to education in Colombia, there is little to situate most of the teaching and learning research in the political, economic or social context in which it is taking place. This renders silent the specific and localised challenges that face higher education teaching in Colombia. One of the few exceptions found in the literature is the framing of bilingual scientific literacy in the context of Colombia's official language program, Colombia Bilingüe (Archila et al., 2018). Paradoxically, the focus on Spanish-English bilingualism in a country that is linguistically diverse reinforces the global dominance of English and highlights the marginalisation of knowledge production in other languages spoken in Colombia.

The literature clearly indicates that measures are needed to promote and support research that makes visible the diverse contexts and localised challenges in the Colombian educational landscape. One measure is the use of critical approaches, such as CCPEE to interrogate the globalisation of teaching and learning research and to foreground localised knowledges, particularly those produced in "peripheral regions such as Latin America" (Guzmán-Valenzuela, 2017, p.5). A CCPEE approach can be used to focus attention on the cultural, political and economic structures that impact on education in different contexts, and to stimulate different types of questions about educational practice (Robertson & Dale, 2015).

Robertson & Dale (2015) propose four key educational 'moments' within a CCPEE approach that provide specific questions to draw out the context in which educational practices take place. These moments guide critical questioning about the nature and context of educational practice, the impact of educational politics and the nexus between politics and practice, the broad political context and social project of education (such as the relationship between education and neo-liberalism), and finally, the outcomes and consequences of the educational process. The purpose of these moments is to stimulate critical questioning about teaching practice from different angles that may not seem evident at first glance and to interrogate educational norms and their unwitting reproduction. In sum, a critical approach stimulates richer, more nuanced and context-based understandings of teaching and learning processes.

6. Conclusion

The literature review reported in this study set out to examine the extent and nature of teaching and learning research in Colombia. It identified a growing body of literature in teaching and learning research, with Spanish and English prevalent as languages of academic dissemination. The literature is being generated mainly by three universities with the common characteristic that each has an educational development centre with a focus on generating teaching innovation, research and publication. The educational challenges emerging from the literature reflect global themes and concerns with little that contextualise them within the social, political and economic contexts of Colombia. This study concludes with a vision for greater visibility of the local context in teaching and learning research through critical approaches that create new understandings of education in a globalised world.

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An example of innovative university teaching: the model of Constructive and Collaborative Professional Participation

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Abstract

This contribution presents a blended course model called Constructive and Collaborative Professional Participation (CCPP), developed since 2005. We will describe theories of reference, course structure, activities performed and methods adopted. Starting from a socio-constructivist framework, both online individual and group activities and offline individual and group activities were organized together with Role Taking, "expert" and "Jigsaw" groups inspired by the Aronson method, web-forum and in presence discussions aimed at building various products. The model has been implemented in university courses about Psychology of e-learning and involves companies from the field to professionalize the activities. Academic and business tutors have been purposely trained, to support students' participation. Following the Design Based Research methodology, at the end of each edition various kinds of data were collected: questionnaires, interviews, and focus groups with the students and feedback from the tutors and the companies involved. The course trained students on skills related to the syllabus, together with communication, organizational and self-assessment skills. Our results also showed how it was possible to develop identity positioning, in particular the transition from positions as students towards professional positioning.

Keywords: blended learning, innovative teaching, online participation

1. Introduction

Today cultural scenario recognizes the centrality of educational systems and the need to innovate teaching practices as a crucial objective. From the Eighth Eurostudent Survey for the period 2016-2018 on Italian university students, emerges a judgment on the acquisition of problematic professional knowledge (Associazione Cimea, 2018). Even if four out of five students declare to be satisfied with their theoretical preparation, less than 50% think they have received a good professional preparation. This highlights the need for Higher Education to improve its role as trait d'union between the formative dimension and the professional domain. This implies a redefinition of its aims and modalities. Kelly and his collaborators (Kelly, Lesh & Baek, 2014) affirm that it is necessary to develop in parallel the analysis of learning processes and those of teaching, looking for points of intersection between how we teach and how we learn. The tools and technologies used in the classroom are important, so the quality of the teachers is determined not only by their ability to teach but also by the capability to orchestrate a rich, stimulating and appropriate environment for students, by knowing how to choose the right tools and methods. This contribution presents a model built to respond to these indications.

2. The model of Constructive and Collaborative Professional Participation (CCPP)

The model called Constructive and Collaborative Professional Participation (CCPP), was developed on the basis of more than 10 years of consecutive application in a university course called "Educational and e-learning psychology", held at the University of Bari (Ligorio & Annese, 2010; Ligorio & Cucchiara, 2011; Ligorio & Sansone, 2009). The model considers learning as a co-construction of knowledge and aims to encourage students to develop new ideas through the creation of both individual and group products (Cucchiara, Ligorio, & Fujita, 2014). The theoretical framework inspiring the course is socio-constructivism (Berger & Luckman, 1966; Gergen, 2001; Kelly, 1955; Potter, 1996; Shotter, 1993) and historical-cultural psychology (Cole, 1996; Scardamalia & Bereiter, 2006). Another source of inspiration is the so-called Trialogical Learning Approach (TLA) (Paavola & Hakkarainen, 2005). In TLA learning settings, students collaboratively develop new objects of inquiry, such as knowledge artefacts, practices, ideas, models and representations. These are 'boundary– objects' designed by one community (e.g., tertiary students) but intended for use in another (e.g., customers of e-learning entrepreneurs in our case).

Therefore, the CCPP model is guided by the idea that people build knowledge through the active production of meanings, products and forms of interaction, negotiation and social collaboration between different contexts. To this end, companies have been involved in the design and implementation of the model, so that the activities included into the model

enhance the professionalization of the course. Online and offline activities are alternated and distributed across two modules (M1 and M2), with an average duration of four weeks for each module. M1 starts with a teacher lesson the in the classroom, during which the educational contents of the module are introduced. M1 ends with the definition of a research question, negotiated with the students, that guides all the activities of the module, which we will briefly describe later. M2 is characterized by the presence of companies that first present their core business and then propose to students to participate in the creation of corporate products. In this module, the learning methods already tested in the M1 will be re-proposed, with the appropriate adaptations. The model requires specially trained professional tutors, which act as mediators between teacher, students, and companies. The activities carried out by the students include:

- Independent individual activities (compilation and maintenance of an E-portfolio for the whole course; compilation of a self-assessment grid at the end of each module);
- Individual interdependent activities (in M1 a personal review of an assigned teaching material; in the M2 an individual report on the work performed with the company);
- Small group activities (collaborative creation of a conceptual map to answer to the research question in the M1; activities coordinated with the company chosen in the M2);
- Plenary activities (presentation of the work done in both modules).

To perform these activities, different types of collaborative learning techniques are used: (i) the Progressive Inquiry Model (PIM) (Hakkarainen & Sintonen, 2002) which considers learning as a process of investigation starting from a broad and general question, proceeds towards its refinement, in order to stimulate the emergence of a critical and scientific thought. This model guides the discussion via web-forum; (ii) the Jigsaw method (Aronson, 1978) with which groups are initially created (called "expert groups") to deepen a certain topic and later these groups are remixed and the participants – coming from different expert groups – are supposed to explain each other what they learn in the previous groups; (iii) Role Taking (Strijbos & Weinberger, 2010) that allows one or more members of a group to take on explicitly defined functions, specific tasks and responsibilities. Students make turn in covering the roles so that each student can try out different ones. The CCPP model uses a type of assessment that encourages students to reflect on their own path and how they learn. During the course, self-evaluation and mutual evaluation (Topping, 2005) are supported through specific tools and interactive moments. The tools used are: (i) the e-portfolio in which personal information is collected together with skills and abilities acquired or purse in the up-coming activities; (ii) the self-assessment form proposed to students at the end of each module, composed of different sections corresponding to the

activities performed (reviews, collaborative products, covered roles, discussions); (iii) an evaluation grid drawn up jointly by the teacher and tutors.

3. The changes made

At the end of each edition of the course, systematic feedbacks were collected through specially prepared forms, from four different foci: (i) students self-assessment sheets; students interviews and Focus Group discussions; (ii) the academic tutors who provided feedback all along the course and questionnaires filled in at the end of the course; (iii) companies that have offered systematic feedback during the course, at the end but also in the time lag between editions; (iv) data recorded in the various platforms used (Forumcommunity, WhatsApp, corporate platforms).

The teacher collected and systematized the various feedbacks and, following the methodology of Designed Based Research (Clarke, Dede, Ketelhut, & Nelson, 2006), identified ways of implementing the feedback in the subsequent edition. These are some of the most significant innovations introduced over the years:

a) We have moved from 10 modules to just two modules. Although a higher number of modules allowed for a greater exercise in the activities, this involved a considerable effort in terms of assessment because each module requires students' self-assessment and a joint teacher-tutor assessment. Furthermore, this generated too much anxiety in the students. In addition, companies increasingly required more time for the activities they proposed;

b) Greater presence of companies. In close interconnection with the previous point, it was decided to offer more time to interactions with companies. This was also a consequence of the adoption of the TLA as a theoretical framework, which lead toward a higher professionalization. In fact, the model was initially called Constructive and Collaborative Participation (CCP) and it was renamed as a result of the expansion of the presence of companies it was renamed Constructive and Collaborative Professional Participation (CCPP) to highlight the increase of companies presence;

c) The technological dimension was expanded. In the early editions, just one platform was used (Synergeia, no longer available); then we moved to more platforms used in combination with various technological tools such as Google Drive, DropBox, Padlet, Webinar, Yammer, LinkedIn, WhatsApp, Articulate, etc. Given the course content (e-learning), it seemed appropriate to offer an extensive technological experience. We also wanted to show, through the concrete use, the variability of objectives that can be pursued with each digital tool. Moreover, we wanted to diversify and expand the range of technology in order to guarantee more ubiquitous and personalized training.

d) More transversal skills. From a follow-up study (Ligorio, Di Maso, & McLay, 2019 in preparation) we found that students remember and appreciate more skills of this kind (communication, group work, self-assessment) as they are better transferable to others contexts, either educational and professional. Therefore, we have amplified the occasions for cooperative work, exchange of mutual feedback, Role Taking, and self-assessment.

e) Simplification of the assessment. Introducing teaching innovation also implies adopting appropriate assessment models. In particular, it was decided not to assess informal communication to protect students free expression. At the same time, it was defined a protocol able to balance the assessment of individual contributions with the evaluation of the processes and products of the group (Sansone & Ligorio, 2015). In the management of this protocol, tutors, companies and students themselves are actively involved.

4. Some results

The effectiveness of the CCPP model has been demonstrated from different points of view.

For example, the Role Taking, and in particular the role of peer-tutor (Sansone, Ligorio, & Buglass, 2016), allows to support and structure online participation through various types of interaction styles, such as the supportive style that stimulates participation and the motivation to collaborate. We found that, through Role Taking, students learnt to consider the group as a means of learning. The model also favors the management and promotion of online agency (Ligorio, Impedovo, & Arcidiacono, 2017) in particular the set of proposed activities and the collaboration within groups aimed at producing challenging products, are elements able to empower agency. Finally, particularly interesting are the changes tracked down about students positioning. We found an emerging sense of group, therefore an increasing We-positioning (Loperfido, Sansone, Ligorio, & Fujita, 2014), and a transition from a positioning as student towards professional positioning (Amenduni & Ligorio, 2017). We believe this data can be at least partially considered as the reason why about 10% of students who attended the course finds a job in the field of e-learning.

Although this paper is mostly based on results already published, its originality lies on giving a comprehensive vision of the course and a systematic synthesis of the main results gathered so far. We also reported here for the first time the list of all the changes occurred in ten years of applications of the model. The application of the Designed-Based Research (Clarke, et al., 2006) allowed to improve the model from one edition to the subsequent and to intercept needs and changes dictated by the specific context of each edition. For example, students showed an increase from one edition to another in their positive attitude towards the use of technologies. The companies, from their side, have revealed an increasing interest in the course by proposing better defined activities and requiring more

time. The tutors have also refined their monitoring and support management skills, contributing to increasing the course effectiveness.

Finally, we consider this model as capable to innovate education by proposing a professionalization of teaching and learning based on contacts with real stakeholders, by collaboratively building challenging products and by fostering the so-called soft skills.

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How authentic is it? Evaluating the products of an authentic assessment task

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Abstract

Authentic assessment tasks resemble activities that are practiced in the workforce. These tasks are valued because they represent what students wish to accomplish as professionals, positively influencing their aspirations and motivations by explicitly demonstrating relevance of assessment tasks. However, given the choice available to students in completing authentic tasks and novelty of outcomes, the products of such assessment may vary in authenticity. This study aimed to develop a method of evaluating authenticity in student assessment products. Second year occupational therapy students (n=59) completed a written factsheet assignment about a disease or condition. The students' products were evaluated for authenticity using a novel rubric developed during the study. The results demonstrate that authenticity in the product of an authentic assessment task is measurable, but varies widely across a cohort, with most products demonstrating moderate to high authenticity. However, there was no correlation between authenticity and course grade. Neither was there a correlation between the grade for this authentic task and a verbal authentic task in another course. These findings suggest that students, at this stage of their education, may not yet have progressed from writing like a professional to acting like one.

Keywords: authentic assessment; factsheet; evaluating authenticity.

1. Introduction

Tertiary institutions across the globe are being encouraged to create authentic curricula to better prepare graduates for the working world (Trede, Macklin & Bridges, 2012). Part of that preparation involves undergoing professional socialisation, to aid understanding of workplace cultures and learning of professional roles (Cornelissen & Van Wyk, 2007). This allows students to acquire knowledge and develop the skills associated with becoming a member of their chosen profession, and adopting its culture, norms and values (Cornelissen & Van Wyk, 2007). An effective way of achieving professional socialisation is through authentic assessment, where individuals experience workplace conditions or tasks that mimic career practises (Burkill, 2009; Kohnen, 2013).

Boud and Falchikov (2006; 2007) define authentic assessment as something that closely resembles activities that are practiced in the workforce, separate from the artificial constructs offered in university courses. Students value authentic assessment because it is a representation of what they would like to accomplish in the workforce (Herrington & Herrington, 1998; Meyers, 2009). It has the potential to positively influence students by raising their aspirations and increasing motivation through explicitly demonstrating the relevance of curriculum activities and career alignment (Frey & Schmidt, 2007).

Many guides on the design of authentic assessment tasks have been published, across various disciplines, and the key features of authentic tasks have been well characterised (Gulikers, Bastiaens & Kirschner, 2006; Burton, 2011; Herrington & Herrington, 1998). These features include: considerations of the fidelity of task to the real world, including realistic conditions and using a variety of resources; that the task produces a polished, valuable product (Gulikers et al, 2006); and the task requires higher order thinking, reflection, metacognition and self-assessment (Herrington & Herrington, 1998; Burton, 2011). Authentic assessment should allow students to determine tasks, make judgments and choices, and generate diverse and novel responses (Burton, 2011). The tasks should be ill-structured, need open-ended inquiry and the construction of novel ideas, and should seamlessly integrate with other assessment (Frey & Schmidt, 2007; Burton, 2011).

However, despite the considerable interest in authentic task design, relatively few studies have evaluated the authenticity of the products students create for such tasks. Given that authentic assessment design should allow students to have choice in their approach to the task and novelty in response, it is likely that students may choose to create products of varying levels of authenticity. The extent to which students create authentic products may be influenced by their knowledge of the skills and practices of their profession, and the tasks they will undertake as professionals. In addition, students are likely to be influenced by their perceptions of the value of the assessment task, particularly its relevance to their

profession, and the instructions and guidance they receive. The aim of this study was to develop a method to evaluate authenticity in the product of an authentic assessment task.

2. Methods

The participants for this study were second year Bachelor of Occupational Therapy (OT) students undertaking a physiology course, 'Human Function in Health and Disease II' at the University of Queensland in semester 2, 2016. Students (n=117) in the course had an average age of 20.5 years, 93% were female and 12% were international students.

Students completed a 'factsheet' assignment, written as if for a healthcare team in a rural hospital. In this authentic assessment task, which was designed to meet the key features of authentic task design (Burton, 2011), students created an information sheet describing a disease related to the physiology in the course, how the disease impacts on occupational performance, and the role of an occupational therapist in its management. The factsheets contributed 17% to the overall course grade, and were marked on scientific content, and on the descriptions of the impact and management of the disease. Students were provided with guidelines for the assignment, however these did not include explicit information regarding layout or writing style except to state that it should be "academic in nature". The assignments were not graded on format or authenticity, so a rubric measuring how authentic each factsheet appeared was created and is described below. Data from consenting students, including their overall course grade and performance in an authentic verbal clinical examination task in a concurrent OT course were also collected and analysed.

Ethics approval was received from the institutional Human Research Ethics Committee prior to the beginning of this study. Of this cohort, 59 students (50%) provided informed consent to participate in the study. A t-test was used to evaluate whether any significant difference existed between the examination performance of students who had consented (44.3 +/- 6.9 out of 60) and the entire cohort (43.3 +/-7.6; p=0.37); as no difference existed it can be assumed that participating students were academically representative of the cohort. Consenting students' data was assigned a de-identified code prior to analysis, which allowed matching of all data sources.

2.1. Measuring authenticity of student product

As no rubrics exist to judge authenticity in student product, a novel rubric was developed (Table 1), using (i) Burton's framework of authentic assessment design (Burton, 2011); (ii) a factsheet checklist developed by the University of North Dakota (2018); and (iii) the assignment criteria rubric. Burton's framework of authentic assessment design presents compelling features of authentic assessment design and 'yes/no' questions derived from each feature. Those features relevant to the product of an authentic task include its fidelity

to the real world, and the judgements and choices students make regarding sub-tasks. The latter is also addressed in the University of North Dakota's factsheet checklist. It is comprised of two main sections: 'content', whether the student has used elements of professionalism in the written content, and 'layout', whether the student has used elements of professionalism in the design. The inclusion of these elements could also be answered with yes/no.

The final compelling feature identified by Burton (2011) relevant to the product of an authentic assessment relates to the accuracy of the work, specifically, whether it is a polished product in its own right. In the context of this product, accuracy was represented by the students' explanations of the subject matter and occupational therapy role, specifically whether these were appropriate and correct. To evaluate this, the marks awarded by examiners to each factsheet on criteria for pathophysiology, symptoms and impact on OT were summed, giving a mark out of 75. To adapt these to the authenticity rubric, marks were stratified into three tiers of equal value: tier 1 = 34-47 marks, tier 2 = 48-61 marks, and tier 3 = 62-75 marks, and a corresponding score of 1-3 allocated for each assignment.

Each factsheet was then graded based on the authenticity rubric (Table 1), giving an overall authenticity score from all criteria out of 9. These were considered as low (1-3), moderate (4-6) and high (7-9) range of authenticity scores. Once constructed, the reliability of the rubric was established via inter-rater reliability, where a naïve researcher independently graded 100% of the factsheets for authenticity using the rubric. Initial agreement between researchers was 95%. Discrepant responses were discussed, and grading revised as appropriate.

To identify if any relationships existed between authenticity in this written task and course grades, a Spearman's rank correlation was performed. These aspects were also compared to students' performance in another authentic assessment task, a verbal clinical examination, that took place in a concurrent OT course. Results are expressed as mean and standard deviation, and were considered significant if $p<0.05$.

Table 1. Degree of authenticity rubric

Content: Does the student mimic a professional?	Layout: Does the student exercise judgment or choice with subtasks?	Accuracy: Is it a polished product in its own right?
Has the student used bullet points/tables? Score = /1	Has the student used a template? Score = /1	Pathophysiology Marks = /40
Is their written work self–contained? Score = /1	Has the student incorporated graphics into their assignment? Score = /1	Symptoms Marks = /15
Have they employed language that is accessible for a lay audience throughout their assignment? Score = /1	Does the student include any indication of OT identity? Score = /1	Impact on OT Marks = /20
		Total marks = /75
		34-47 marks = Tier 1
		48-61 marks = Tier 2
		62-75 marks = Tier 3
Content score = /3	Layout score = /3	Accuracy score = /3

3. Results

Overall, students' factsheets (n=59) had an average authenticity score of 5.37+/-1.61 out of 9. The majority of students (66%) incorporated elements of professionalism in their factsheet assignment, so consequently most had moderate authenticity scores ranging from 4-6 (Figure 1). With regards to authentic writing, 51% of students elected to write in a professional voice. In terms of presentation subtasks, 65% of students opted to use a template; images or graphics were included by 72% of students, but only 13% displayed any sort of identification as an OT in their assignment. The majority of students (80%) used bullet points and/or tables, which are also indicative of an authentic product. The marks awarded by examiners on criteria relating to the pathophysiology, symptoms and impact on OT gave a mean accuracy score of 56.42+/-10.36 out of 75.
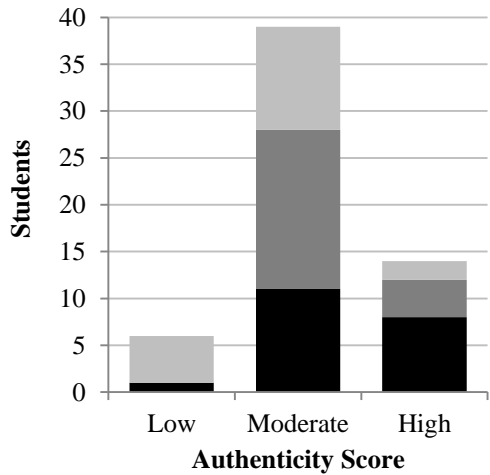
Figure 1: Authenticity scores for factsheet assignments. Each factsheet assignment (n=59) was allocated a score using the authenticity rubric and divided into low moderate and high score ranges. The grey scale represent scores of low (black), middle (dark grey) and high (black) levels within each range.

Authenticity score was not significantly correlated with physiology grade, nor with scores on the OT verbal clincal examination task or grades in the OT course. However, significant positive correlations were observed (Table 2) between scores on the OT task, grades in that course (r=0.79; p<0.0001); and physiology grades (r=0.301; p<0.05). To elucidate if there were any specific aspects of authenticity that were related to grades, further Spearman's correlations were performed. These showed that accuracy was positively correlated with physiology course grade (r=563; p<0.0001), but not other OT task score or course grade, whereas content and layout did not correlate with any of these aspects.

Table 2. Spearman's rank correlation matrix of authenticity, scores and course grades.

	Authenticity	OT task score	OT Grade
Authenticity	-		
OT task score	0.018		
OT Grade	0.117	0.790****	
Physiology grade	0.198	0.301*	0.580****

* p<0.05; **** p<0.0001

4. Discussion

The aim of this study was to examine the authenticity of the products of assessment created by university students. Before this could be addressed, methods of characterising authenticity needed to be created, which gave rise to a preceding aim: to develop a rubric to evaluate authenticity in student products. The synthesis of existing literature allowed the creation of a novel rubric that could quantify authenticity and enable the identification of discernible differences in the level of authenticity of student assessment products.

The main distinction in students' factsheets was whether they were presented like a student assignment or as a professional product. This requirement is mostly satisfied from the appearance of content and layout, where most students exercised an option to use aesthetic elements such as templates, graphics, bullet points and tables to make their assignment look professional. Of particular interest was whether students decided to write like a professional, in that they used language that was accessible to a lay audience and self-contained, with just over half doing so. The majority elected to employ elements of professionalism even though it was not a requirement of the assessment task.

The authenticity rubric adapted criteria from three different sources: Burton's compelling features of authenticity (2011), The University of North Dakota's factsheet checklist (2018), and the assignment criteria. The need to amalgamate these sources arose from a lack of pre-existing methods for evaluating authenticity in a student product; consequently, it is a new and unverified measure. Limitations are unavoidable when the research conducted is novel, but certain actions should be taken to ensure the measurement is reliable (Cowin, Johnson, Wilson & Borgese, 2013). Thus, an inter-rater reliability test was used (Armstrong, Gosling, Weinman & Marteau, 1997). The resultant agreement suggests that authenticity was judged similarly by a naïve researcher in this measurement system.

Rather than 'checking boxes' in order to generate an authenticity score, potentially an easier way to evaluate authenticity is to observe the subject in an authentic setting in real-time. This occurred during the OT clinical examination task in the concurrent course. Although also authentic, the factsheet is marked on how accurately students describe physiological symptoms and intervention strategies in their writing, whereas the clinical examination is marked largely on verbal interaction with a patient. While authenticity was not marked explicitly in the OT task, it is not unreasonable to suggest that examiners marking clinical assessments are discretely marking for authenticity overall, as they are looking for similarities between the student's actions and that of health professionals (Thomas, Saroyan & Dauphinee, 2011).

The lack of a significant relationship between authenticity in the physiology and OT tasks imply a distinction between the authentic assessment types, as the correlation between physiology and OT course grades indicate students should achieve similar results across

both courses. It is possible that at this point in their program, students are only at the stage of writing like an OT, rather than acting like one (Rodger, Turpin & O'Brien, 2015). This is supported by the fact that few students assumed the role of an OT in their factsheet. It seems clear that their professional writing has not yet progressed to seeing themselves as medical professionals, which is directly related to professional socialisation (Smith & Hatmaker, 2009). For this reason, it would be beneficial to evaluate the products of authentic tasks from later in the students' program, to evaluate the progress of the students' self-perceptions.

At the time of these courses, the OT students were only just beginning their clinical placements, so had not yet had much contact with practising occupational therapists through their program. Authentic settings, such as placements, have been shown to present major challenges for health students (Bramming, 2007). The strongest learning on the path to professionalism occurs when students face a crisis that is challenging and confronting, which forces them to stop, think and reflect (Bramming, 2007). The fact that these students have not yet faced such a challenge is reflected in their inconsistent grades for authentic assessment tasks in physiology and OT. Potentially, when these methods of socialisation occur, students will progress from writing like a professional to acting like one.

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Women and foreign students in teams: the key players

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Abstract

The aim of this proposal is to present a teaching experiment that has been in use since the academic year 2012–2013. The experiment concerns the introduction of a norm to direct the self-assessment of individual participation in the making of group reports. The presence of this norm can limit potential free-riding or conflicts inside each team. Statistical results from more than 400 students who participated in this experiment confirm that this norm was effective in reducing misleading individual behavior. In addition, this effect turns out to be associated with the presence of women and/or students from abroad in each group.

Keywords: Norm; Team work; Exchange students; Women.

*** This document includes ideas, opinions, and conclusions drawn by the author, and they do not express the views of the UAB. Any error is the responsibility of the author.

1. Introduction

The teaching experiment we discuss in this study has been in place since the academic year 2012–2013. It is addressed to activities subject to grading for the course External Trade (*Comerç exterior*) in the Faculty of Business and Economics at Universitat Autònoma de Barcelona.

The material discussed in the course aims at introducing students to basic knowledge of contracts widely used in international trade as well as administrative practices. The teaching process provides opportunities for students to produce group reports as part of their learning process. In particular, the group activity is thought to develop transversal skills as stated in the teaching guide.

This course is taught in both Spanish/Catalan and English and is credited towards a degree in Administration and Business Economics. It is an elective course during the first term (September–January) and is usually taken by local students during the last year of their degree as well as by international students visiting UAB under the patronage of the ERASMUS program or other agreements signed with foreign universities.

The School of Business and Economics at UAB is a pro-active institution with approximately 200 incoming students each year (for one or two terms). They account for approximately 50–60% of students enrolled in English-group teaching.[1]

Students are expected to create and present a group report, which accounts for 15% of their final grade. All required information about the content and the structure of this report is in the guidelines posted on the course webpage. Students are required to meet some milestones in making the document. The lecturer of the group supervises their jobs. Before introducing the norm (to be discussed in the next section), the lecturer was often required to solve conflicts among group members and, similarly, he/she received several complaints about free-riding or misleading behavior of some group members. These situations are discussed in Del Canto et al. (2009). The introduction of the norm was thought to reduce these problems and identify the potential patterns to limit the problems resulting from incomplete control over the process of report making.

As we will describe in this paper, the adoption of a norm was successful not only because it limited group conflicts, but also because it allowed some interesting conclusions to be drawn about the group composition and their expected behavior (something that will be implemented in the next step of this experiment). The presence of women and foreign students seems to be a deterrent to misleading declarations.

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[1] A complete description of the internationalization policy of the school can be found in Nicolini and Roig (2016).

The structure of the document is as follows. In Section 2, we describe the structure and organization of the teaching experiment, and in Section 3 we present and discuss some numerical evidence and statistical results. Finally, Section 4 concludes.

2. The Teaching Experiment: A Description

This teaching experiment has been carried out from the academic year 2012–2013 up to the most recent year (2018–2019). Given its implementation over time, it has been possible to gather data and build an original database allowing the identification of some salient features of individual behavior and, then, draw some empirical-ground insights about the best way to organize the team group tasks in order to overcome the drawbacks identified previously.

The tasks to be performed by a team (whose size can vary between two and six persons) require that the team members perform an easy research job to address some questions referring to the internationalization process of a selected product with a representative Spanish brand that is an international exporter of that product. In the webpage for the course, students will find some instructions posted with the different milestone points that they need to include in their document. Once completed, the document is delivered to the lecturer and group members must give a public presentation of the most salient content of their research to the other students. The report and presentation are subject to grading, and they jointly contribute to 15% of the final grade for each student. Students are advised of the grading policy at the initial class meeting. They also know that the percentage included in the joint declaration will be used to tailor proportionally the grade of the team report assigned to each team member. Students learn that although they deliver a joint report, they can receive different scores. In this task, students are required to have an active role in the evaluation process (Bretones, 2008), and they also learn the importance of properly fulfilling all required learning tasks differently than with a classic exam (Alcañiz et al., 2015).

In the making of the group report, the key issues to control for were conflicts among team members and the risk of free-riding behavior. In this respect, an important task for the lecturer is to introduce a device that will allow for tailoring the score of the report so that it fits the true participation of each group member. In order to control for this, the lecturer chose as a controlling device a *behavioral norm* that all students participating in the team activity must fulfill. This norm is that when delivering the final version of the group project, each team also has to deliver a joint declaration (signed by all members of the group) in which each member has to quantify (in percentage) and declare her/his participation in the making of the report. The fact that this declaration must be signed by all the members of the group implies that they all agree with the self-declared individual

percentage quotas. The rationale behind this requirement is to create a psychological pressure among team members by means of reciprocal control in a way that will reveal private information rather that hiding it. This behavioral association between cooperation and trust among team member has been widely studied in the theory of incentives (La Porta et al., 1997). There is common agreement that the introduction of a norm as a tool for controlling deviating incentives is more effective than any other type of punishments in limiting unfair behavior (Gneezy & Rustichini, 2000; Acemoglu & Jackson, 2017).

3. Empirical evidence and statistical results

The introduction of this norm was successful. This requirement eliminated any conflict situation that was previously reported to the lecturer (the person expected to solve them). In the same way, it also helped students by making them aware of the importance of performing the joint task under the best collaborative conditions. But, beyond these qualitative results, it is also important to analyze from a quantitative perspective the potential insights this experiment can deliver into creating the most effective team to fulfill this task.

The collection of data referring to this teaching experiment began in 2012–2013 and covered seven academic years involving 439 students organized in 143 groups.[2] The definition of the selected variables is in Table 1.

Table 1. Variable definitions

Variable	Definition
Group size	Number of individuals belonging to the same group
Gender	Dichotomous variable (1: Female; 0 Male)
Exchange students	Dichotomous variable (1: Erasmus or other exchange students; 0 otherwise)
Gender exchange students	Dichotomous variable (1: Female & Erasmus or other exchange students; 0 otherwise)
Uniform declaration	Dichotomous variable (1: All group members declare the same participation to the group report; 0 otherwise)

Some preliminary statistics help to elucidate the distinguishing features of this group of students (Table 2).

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[2] In the statistics, some observations are missing because students or the official records of the faculty did not report complete information. All statistical results are produced using *STATA14* software.

In our data, the presence of women (*gender*) and foreign students (*exchange students*) accounts for 56% and 54% of the sample, respectively. The average size of the group (*group size)* is about three, and the percentage of declaration in which the members declare an identical share of participation in the making of the group report (*uniform distribution)* is about 77%, while in 23% of the cases the students delivered non-uniform declarations.[3]

Table 2. Descriptive statistics

Variables	Obs	Mean	Std Deviation
Group size	439	3.35	1.01
Gender	438	0.56	0.49
Exchange students	439	0.54	0.50
Gender exchange students	438	0.31	0.46
Uniform declaration	418	0.77	0.42

Source: Own elaboration.

As for a further preliminary inspection of the most salient features, we perform a simple exploratory exercise with the aim to identify the existing statistically significant correlations. This exercise consists in computing the correlation between each couple of variables jointly with its correspondent statistical significance (Table 3).

Table 3. Correlations

Variables	Gender	Uniform Declaraion	Exchange Students	Gender Exchange Students
Gender	1	**-0.08***	0.05	**0.60*****
Uniform declaration	**-0.08***	1	**-0.14*****	**-0.14*****
Exchange students	0.05	**-0.14*****	1	**0.63*****
Gender exchange students	**0.60*****	**-0.14*****	**0.63*****	1

Source: Own elaboration. Statistical significance: ***1%; **5%; *10%

Our preliminary data exploration identifies a negative association between the gender dimension or the condition of being a foreign student and the delivery of a uniform

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[3] It corresponds to approximately 16% of the groups.

declaration. We do not use a specific tool to control for the honesty of the team members when producing the declaration. In case of a uniform declaration in which each team member declares an equal share of participation in the making of the group report, it is likely that this declaration could mask some free-riding problem. Team members are likely to implement direct or indirect compensations to avoid discrimination in the individual grade granted for the group report. In this view, the delivery of a declaration that gives differing percentages for participation of the group members to the making of this report is less likely to hide this type of behavior. Correlation statistics reveal that this building of an agreement among team members is less likely when there is a woman in the group, and the same holds in the case of exchange students. In the case of women, this result can be associated with a natural aptitude and a degree of involvement in the performance of a task with a clearly declared reward (here, the *grade*). This type of behavior has been well studied in the literature, especially dealing with the way women work in business teams (Bohnet, 2016). As for the case of exchange students, two arguments can be put forward to understand this phenomenon. One refers to a simple environmental situation: incoming students from foreign universities spend one or two terms at UAB in the same academic year. Given that this course is scheduled in the first term, it is quite likely that this group of students has not had the opportunity to form effective social networks (mostly composed by mates) in order to provide alternative incentives (including corruption) for endorsing free-riding behavior, as can happen with natives who have already completed at least three academic years together.[4] It is also important to take into account the role of culture in the planning of free-riding behavior (Nicolini & Roig, 2017). Exchange (foreign) students usually bring social values (or norms) with them from their home countries and introduce them into the local culture. Alm and Torgler (2006) extensively discuss important differences in home and host cultures experienced by individuals moving from one country to another and the way they adapt their individual behavior.

In Table 4, we gather the results of estimations about the probability of getting uniform declarations (ones in which students declare that they contributed equally to the preparation of the joint report) on the basis of the two key features (gender and nationality of the students) previously detected.[5] This probability is obtained as *marginal effects*. The marginal effect of each independent variable is the probability of success in a *probit* model (here, delivering a uniform declaration). This probability is evaluated for each observation and the statistic we report is the average of those probabilities.

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[4] This issue is discussed in Del Canto et al. (2009)

[5] These estimations are reached using a *probit* model taking into account the temporal dimension since our data comes from different waves of students.

Being a woman or a foreign student seems to be a deterrent to the delivery of a declaration that could hide some misleading or free-riding behavior. The joint combination of the previous two features (corresponding to foreign women students) turns out to be more statistically significant, but the size of the coefficient is not statistically different.

Table 4. Probabilities of getting uniform declarations

Variables	Marginal Effects	Pseudo-R^2	Time Effects	Observations	# Equations
Gender	**-0.11*****	0.08	YES	417	**1**
Exchange students	**-0.10****	0.07	YES	418	**2**
Gender exchange students	**-0.12*****	0.08	YES	417	**3**
Gender	**-0.10****				
Exchange Students	**-0.09****	0.09	YES	417	**4**

Source: Own elaboration. Statistical significance: ***1%; **5%; *10%

Comparing the previous statistical results, we can formulate two relevant conclusions:

1. The presence of *exchange students* in a group statistically reduces the probability of getting a uniform declaration (in which all members declare an identical participation share in the fulfillment of the group task) that is likely to hide potential *free-rider* behavior. Therefore, this entails an improvement of the credibility of the joint declaration.

2. The *gender* dimension is relevant for reducing the suspected free-rider behavior as well. The presence of women makes no uniform declaration more likely to be delivered. Their role does not seem to override the presence of exchange students in the group (Equation 4 in Table 4). When considering the joint presence of women (native or foreign) and foreign students, they are both statistically significant deterrents for uniform declarations, and the size of their coefficients is comparable.

4. Conclusions

The device introduced for evaluating the individual involvement and effort in the preparation of a group report is effective. The norm allows for creating psychological peer pressure making students less prone to free-riding behavior. One interesting insight gained from the statistical analysis is the identification of gender and foreign student status as two

key factors in preventing collusion in the groups. In the previous sections, we argued the potential reason for this outcome is not in the economics or psychology literature, but, instead, it is in the education setting. Once this result has been accounted for, the next step of this teaching experiment will be the adoption of these findings in group creation by requiring the presence of at least one woman or foreign student. The purpose is to evaluate the effectiveness of this decision in reducing the rate of potential false uniform declarations (masking corruption or the existence of parallel aside deals) and put forward our analysis by referring to the quality of the reports. The idea is to assess whether teams with women or foreign students are also the ones that deliver better reports. This second step needs to be planned carefully because we must define and introduce some indices of quality that need to be consistent over time. But this effort is worthwhile as it can improve knowledge about the way to build effective working teams in the classroom.

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The Benefits of an action reflective assessment using role-plays in teaching mediation

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Abstract

Introducing action reflection learning into a law course to instil life-long learner skills and enable students to adapt to a new style of lawyering is essential if 21ˢᵗ Century lawyer needs are to be met. The paper describes the assessment, and the use of active reflective learning in a mediation course taught in an Australian law school. The benefits of such learning are described with specific attention to law teaching. Student reflections indicate the notable difference this teaching method had for their learning and development of a conflict resolution advocacy style.

Keywords: Action reflective assessment; role-plays; mediation; legal education.

1. Introduction

Today's legal practitioners are adjusting to a different type of legal professional practice. Instead of 'warrior' lawyers relying on rights-based processes as an outcome achieved by the lawyer taking charge of the client's problems, clients are demanding a nuanced approach that requires a very different style of lawyering. This new professional is required to use communication not in a strong partisan advocate, winner takes all approach, but rather to advance their client's interests in a holistic and collaborative manner that sustains relationships and satisfies wider interests than purely monetary ones. Macfarlane (2008) has described it as a 'seismic change' from adversarial advocacy to conflict resolution advocacy (p.62). The dilemma for the law student is that much of their law school curriculum still focuses on adversarial advocacy. This can present a major block to adoption of a holistic conflict resolution communication when it comes to mediation training within a law school. Students have likened it to wearing two different hats. Adapting to the collaborative communication over a rights-based communication can be very difficult. It requires both, allowing greater ownership of the conflict resolution by the parties; and a recognition of the importance of needs and interest beyond mere rights.

Australian law students in particular are required to attain a Threshold of Learning Outcomes (TLO) based on six TLOs (Kift, et al 2010). TLO 6, Self-management, requires a reflective capability as a core skill (Marychurch, 2011). This is expressed as an ability for students to '(b) reflect on and assess their own capabilities and performance, and make use of feedback as appropriate, to support personal and professional development' (p.1) It has been fleshed out in the Good Practice Guide on how to teach and assess reflective practice skills (McNamara et al 2013). The reflective activities in the course support a self-management approach to learning by adjusting after feedback and reflection appreciating the development in capability and skills.

In a mediation law course delivered at both undergraduate and postgraduate levels in an Australian regional university, implementation of realistic role-play scenarios enables groups of three students to perform 'mock' mediations. Four mediations are conducted of around 90 minutes each, over a period of two days. The participants debrief immediately, both during and at the end of the role-play with each other and the coach. Debriefs are achieved by appropriate questioning eliciting the information the parties require to reflect on their learning. Each subsequent role-play builds on the reflective learning from the previous. This goes beyond a problem based learning that relies on adopting solutions centred on past experience, to instead follow action learning, requiring reflective practice and acting upon thinking concomitant with learning.

Action reflective learning allows assessors to set tasks that incorporate the elements of reflection, which include some form of real problem, or experience that is related to the

participant's professional context, multiple participants, a range of potential responses, and opportunity for reflection both individually and in the group, and with an expert action learning coach (Marquardt 1999). The coach helps the participants by prompting, through appropriate questioning, active reflection, aiding in linking reflection to the theory, and guiding the improvement of skills. Freire's (1972) notions of praxis in which practice is purposefully integrated with the theory support this. Four schools of action learning have been identified, as 'tacit,' scientific,' 'experimental' and 'critical reflection' (Rimanoczy 2008). The latter is adopted in the law course discussed in this paper. Critical reflection involves addressing the context in which the problem arises by challenging assumptions, encouraging alternative approaches and inducing an empathetic appreciation of the consequences of actions as they affect outcomes and other parties. Action reflection provides a sustained and deeper learning that assists universities to produce 21st Century graduates.

After outlining important aspects of action reflective learning this paper then links this to a description of the course and assessment. The benefits this learning and assessment approach brings to students is then discussed. Student reflections reported in this paper are drawn from a final reflection post to the study desk (from across 3 semesters) in which on average 250 students are taught in each semester. The following questions were posted on the study desk:

> Describe some important things you have learnt in the course and if this has changed your thinking/approach to dispute settlement. What areas do you think you need to know more about and to develop in yourself?

Ethical consent was obtained to publish anonymized students' responses.

2. Action reflective learning

Action reflection can occur in varied ways and this can create a lack of certainty as to what reflection assessment entails. The variety of models bringing theory and practice into an action reflective learning approach (Dewey, 1933, 1938; Schön 1983; Rogers 2001; Bond 2015), have been suggested as a success factor in action learning. The inbuilt flexibility allows for adult learning that ranges across cognitivist, behaviourist, humanist, constructivist, and social learning.

Dewey (1933, 1938) was seen as an early figure contributing to the concept of reflection in learning, noting that experience alone is not sufficient, but requires reflection on experience to actually learn from it. This supported action "…in a deliberate and intentional fashion…" in order for the individual to seek answers derives from a constructivist rather than behavioural view of learning (Dewey 1933, p.212; Bond, 2015, p.6). Friere (1972) refers to the need to adopt a critical thinking approach in which reflection can lead to problem solving by using complex thinking to overcome an otherwise narrow learning of information often

not contextually situated (Bond 2015).

Schön (1983) was another early proponent in describing 'reflection-in-action' and 'reflection-on-action' (Ryan and Ryan 2012, p. 2). Schön's theory situated within everyday practice has been challenged as not providing the level of reflection required by Friere and others to initiate change and escape 'oppressive' practice. This provokes a constructivist view of learning that contests the idea of an accumulated linear learning. Constructivists prefer to see knowledge as individually socially negotiated, leading to an absorption of new learning (Bond 2015, p. 5).

Drawing the theories on reflective practice together Rogers in 2001 described reflection as:

> a cognitive and affective process or activity that (1) requires active engagement on the part of the individual; (2) is triggered by an unusual or perplexing situation or experience; (3) involves examining one's responses, beliefs, and premises in light of the situation at hand; and (4) results in integration of the new understanding of one's experience (p.41).

Each of these aspects are present for law students when learning a new communicative process through active application in a group mediation role-play. The group reflective exercise brings together people who have a shared knowledge, goals and attitudes that supports student learner self-assurance. Using the knowledge achieved by action reflection can result in a change of behaviour and ability to lead and adapt to change as the approach instils a confidence in students' ability to transition to professional practice (Sofo, et al, 2010).

Teaching reflective practice throughout the curriculum is important for students in order for the practice to become ubiquitous in their later professional capacity. However, this can be challenging for law students who are habituated to learning through a didactic approach based on following the Issues/Rules/Application/Conclusion (IRAC) concept (Graham 2015). This involves stating the issue in a problem scenario, identifying the related legal rules, then applying these to the given set of facts and drawing a conclusion. Summative assessment based on such an approach can fail to establish a lifelong learning approach that enables self-awareness of any gaps in knowledge and skills (Kift et al 2010). Reflection involves empowering students to take more responsibility for their learning. Without this, students risk becoming dependent on external rewards that fail to instil self-assessment of their capability to become a successful practitioner (Hammer et al 2012).

Further benefits from using a reflective learning approach include the potential to assist with law students afflicted with anxiety and depression (Skead and Rogers 2014; Collins 2016). Summative assessment can create a negative self-perception and is often experienced as separated from the learning process (Bond 2015, p.1). Reflective action learning assists

graduates' flexibility and adaptability in responding to the context, developing their emotional intelligence and recognition of mental patterns, dialogue and personal interactions (Sofo et al 2010, p.213). This in turn may aid students' confidence and mental health (Field and Duffy 2012).

Providing an opportunity for reflection on action is important in law as it teaches the skills of self-regulation along-side core content knowledge. Reflexive questioning creates a meta-awareness of how one's dialogue affects others including whether it can escalate or de-escalate conflict. The skill is critical to survival of not only the individual but also organisations operating in the 21st Century when changing environments, new technologies and flexibility are demanded. Creating a learning approach while still a student that inculcates values and ethical understanding based on one's actions enables good judgement when exercising professional responsibilities. This is important to those wishing to become resilient mediators.

3. The Assessment

Being a first year course (Law1122) and an early elective course in the Juris Doctor program (Law5122) the assessment gives the students a timely and beneficial understanding of the advantages of learning by doing and reflecting. This is taught to raise awareness of the student's metacognitive abilities. Essential aspects for action reflective learning include providing a challenging or new experience and a setting that encourages reflection (Rogers 2001, p.42). With these in mind the role-play mediations challenge students that have been put through a scaffolded structured learning, starting with relevant theory, then the mediation process, and finally combining the two in praxis. The predominant emphasis on rights based adversarial lawyering is directly challenged through this experience. It encourages students to question their world-view and assumptions. The following student reflections express the learning in moving to a conflict resolution advocacy, and experienced benefits not observed in an adversarial approach:

> I began working in a law firm at the age of 16 … It has been constantly stated to us that we defend our client's rights and protect these at all cost and this has been the only real approach that I have ever been exposed too.

> Mediation is another way that the perceived view of lawyers can be improved, as they … do not overly assert their authority but create a safe and relaxed environment.

> … this course … really allowed me to alter my thinking with regards to resolving disputes…Most importantly, I'd say I've come to learn

> that winning isn't everything and that issues can actually be negotiated in a sense that allows both parties to 'win'.

Creating supporting assessment around the mediation role-play animates students' engagement in the process. The modelling of reflection by the coach and teaching team through appropriate questioning, demonstrating exemplars and guidance providing clear expectations and discussion helps the approach become embedded and integrated in a normalisation that nurtures reflective practice (Bond 2015). The coach facilitates learning by using guiding questions and interventions that focus attention on what is achieved well and what still needs to occur (Sofo et al 2010). Modelling a mediational conflict resolution approach, the coach empowers the students by creating a safe environment. This is supported by clear direction and criteria guiding the students towards desired learning outcomes.

There are a number of opportunities for reflection provided in Law1122/5122. One of the main assessment items is a reflective written assessment (worth 35%) requiring the students to document and respond to one of four role-plays occurring over two-days in a face-to-face intensive. The diversity of feedback sources provided during and immediately following each role-play provides a critical richness in the learning experience. Students get to 'feel' the consequences of theirs and others actions. The intensive delivery of the active learning events enables an instant uptake of their reflection and response by putting it into practice in the next role-play. Beyond the individual and group reflection the whole class, comes together to share their learnings at the end of each role-play in an overarching debrief that adds to the diversity of voices to create thought-provoking insights.

Having learned the theory, process, and skills in scaffolded prior sessions the students are required to identify how this informed their experience by reflecting on the links between theory and practice in the written assessment. Each student experiences the mediations from the perspective of both mediator and a party as they rotate between the roles of party, and mediator. Contemporaneous notes from each role-play assist the further individual reflection in the subsequent written assignment. This requires students to select two scenarios, one as mediator and one as party from the mediation exercises. Students use these scenarios to link their experience with theory by critically commenting on which areas of the mediation process were successful or otherwise, and to conclude with an outline of key communication techniques utilised, evaluating their effectiveness with reference to theory.

Active learning reinforces and develops ability and skills in a short period giving a growing confidence, sense of achievement and self-esteem. This is witnessed by the expert coach as a dramatic improvement between the first and last role-play. Students describe the learning as an authentic 'real world' experience:

> … the discussion seemed 'real world' and I believe the skills and the way of thinking
>
> … are very transferable to other situations as a lawyer.
>
> … 'real world' application of the law is very different to the textbook approach.

Through constructing contextual and memorable experiences, student learning goes beyond the content to incorporate the self. Active involvement means the body memory is activated as more senses are engaged. Initial group reflection followed by written reflection provides the student with an opportunity for making the deep connections required for a lasting and profound awareness in order for their professional self to appear. A metacognitive awareness involves thinking about thinking in an active cognitive approach in which the self observes while also actively engaging in the role-play event. Memory is activated through the greater use of the senses and self-awareness (Bond 2015, p.3).

The individual written assessment provides a means to view the experience through a contemplative lens. In a holistic manner, the praxis experience relates current knowledge to past learning to create new learning. This can prompt conscious changes in behaviour based on a deeper reflexive understanding of when to use what skills. The following reflections indicate the meta-awareness of students' learning:

> I was able to identify and develop the skills … to communicate with clients of different cultures and backgrounds …
>
> I know that I have to work on being more impartial. I thought that this was something that I would be good at, although while studying this module I have found otherwise.
>
> I've always been a 'listener' and now I understand something of why that can help others...
>
> … by studying active listening and non verbal communication I gained a greater understanding of not just myself but others. Although I have to admit that I still need to practice my active listening...
>
> Minor things such as interpreting people's body language is a trait I greatly undervalued and this course has demonstrated the usefulness of this.

A final reflection in a group post-action forum at the end of the course helps the students appreciate their most momentous learnings, and why they are significant. It moves beyond a description of an active learning exercise to the questioning of the students ideas and what motivates their world-view through self-critique. It demonstrates how the action reflective approach has assisted in overcoming Freire's concerns with breaking free of the oppressive:

It's… hard to imagine what the practical process of doing law is when we're studying it. I have gained a greater understanding of the theory by putting it into practice.

I learned so much about myself and what a challenge it is to step back and not get involved emotionally …

Before I had always considered negotiations (involving lawyers) as the only real step to take before going to court, but now I understand that there are a lot of other options to try.

I have now gained the knowledge of why and how we do what we do to reach a positive outcome for our clients.

I found myself reading the types of personalities and saying… "I know someone like that at work" and thinking about the last disagreement you had with a friend and thinking … perhaps if I had approached that a little differently things might not have gotten so out of hand.

4. Conclusion

Integrating a reflexive approach throughout a course both in a formative and summative manner develops the life-long learner and creates a meta-cognitive aware professional practitioner who is more likely to resist oppressive practice to become an informed flexible and adaptive lawyer. Including the student, instead of just the teacher in the assessment process intensifies the learning.

Key outcomes in the active reflective learning experience for a mediation course for law students include improved individual cognitive awareness and the ability to change behaviour, group reflection and feedback skills, reflexivity as a professional, learning that is remembered as it engages all senses, and lifelong active learning approaches.

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Alternanza scuola-lavoro (work-based learning) as a resource for higher education[1]

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Abstract

In Italy, Law no. 107/2015 made obligatory for all second grade secondary school students to spend a certain number of hours on alternanza scuola-lavoro activities (work-based learning). For Italian schools this opened up new horizons as well as new challenges on multiple levels: organisational, didactic and educational. Anyway Legal provisions and scientific evidence are in fact not sufficient to guarantee quality because school and work contexts are systems guided by different motivations, models and mechanisms.

"Tailoring" and "co-designing" are the main characteristics of alternanza programmes offered by Università Cattolica del Sacro Cuore; to investigate the quality of these experiences a survey has been launched.

Whilst the study confirms the satisfaction of the participating schools, from the perspective of ongoing improvement, a number of areas for development emerged in relation to evaluation issue in particular.

Beyond the experience itself, universities should consider alternanza a major topic for consideration, since it enhances their fundamental activities: research, education and the third mission; accommodating students on alternanza programmes is therefore a means of responding to local needs but also an opportunity to consolidate university development strategies.

Keywords: Alternanza (work-based learning); Assessment; University; Research.

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[1] Katia Montalbetti wrote the paragraph n.1 and Cristina Lisimberti the paragraph n.3. The paragraph n. 2 was written together.

1. *Alternanza scuola-lavoro* (work-based learning) in the Italian context

The issue of the link between school education and the world of work has been widely developed in recent decades, and increasingly challenged by the difficulties facing the national and supranational economy (Vecchiarelli, 2015). In Italy, Law no. 107/2015 completed a process, not entirely without difficulty, of progressively integrating on-the-job education into school curricula (Gentili, 2016). In the academic year 2015/16, this law made it obligatory for all second grade secondary school students to spend, over the course of three years[2], a certain number of hours (depending on the subject[3]) on *alternanza scuola-lavoro* activities. For Italian schools, particularly those not directly geared towards preparing students for work and with a less developed tradition of apprenticeships and placements, this opened up new horizons as well as new challenges on multiple levels: organisational, didactic and educational (Torre, 2016, 2017; Crivellari, 2018). These changes not only affected the way schools were run internally, but also brought to the fore their relationships with the local area in terms of mutual enhancement (Fedeli, Tino, 2018).

In the literature, international studies conducted on experiences of Work-Based Learning (WBL) and Work-Related Learning (WRL) (Gibbs & Armsby, 2010; Bertagna, 2013; Dalrymple, Kemp & Smith, 2014; Schaap, Baartman & de Bruijn, 2012; Akkerman & Bakker, 2012; Flynn, Pillay & Watters, 2016; Fabbri, Melacarne & Allodola, 2015) have widely acknowledged the educational and training value of work contexts (Wesselink, De Jong & Biemans, 2010). Nevertheless, legal provisions and scientific evidence do not guarantee quality *alternanza* programmes. In fact, the two systems in question are guided by different motivations, models and mechanisms: it is, therefore, essential that they gain mutual knowledge and understanding and learn to collaborate (Cuppini, 2018).

Unlike previous placement or apprenticeship activities, *alternanza* activities take place within a single school-run training project (Nicoli & Salatin, 2018). The school must plan, implement, monitor and assess the programmes based on special agreements with the hosting organisations. In this sense, *alternanza scuola-lavoro* is designed as the extension of school-based learning activities outside the class room in real contexts (Sicurello, 2016), which must be properly prepared to accommodate students in order for the experience to succeed (Sappa, Choy & Aprea, 2016).

On the one hand, schools must learn to "look further" and, on the other, companies/institutions must be prepared to engage with students beyond the formal level, offering them the opportunity to participate in authentic experiences. The potential of

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[2] Students from 16 to 18.

[3] In the three-year period, 200 hours (high schools) and 400 hours (technical and professional institutes) untill a.s. 2017/2018.

alternanza is not limited to professionalization, but has a particular educational impact too, in that it aims to develop students' self-awareness so that they can plan their own future based on a realistic interpretation of the world.

For universities, therefore, accommodating students on *alternanza* programmes is a means of responding to local needs and demand but also an opportunity to consolidate their own guidance strategies. This two-fold perspective (Montalbetti, 2018; Loiodice *et al.,* 2018) forms the backdrop to the experiences in a private Italian university described over the following pages.

2. *Alternanza* at the Università Cattolica del Sacro Cuore

2.1. The Structure of the model

Università Cattolica del Sacro Cuore (UCSC) has received students as a participant in the *alternanza scuola-lavoro* scheme since the latter was introduced into schools in 2015/16. The activities are becoming more established over time: during the last three years in question (2015/16-17/18), the participating number of schools and students grew to 53 schools (nearly all *licei* secondary schools) and 412 students in the last school year (2017/18) involving humanistic and scientific faculties.

For UCSC, *alternanza scuola-lavoro* is an opportunity to meet and engage with local secondary schools, students and teachers in a relationship that extends beyond the organisational dimension, being based on the recognition of this experience as a valuable source of guidance. Indeed, participating schools become part of a network enabling them to enhance the opportunities the students receive by continually collaborating with the University and co-designing the activities and itineraries. As well as on an educational level, students are also offered opportunities for development on a personal level in the form of a continual relationship with the *Ufficio Orientamento* (student guidance office), which remains an important contact even after the end of the course, helping students develop a personal plan for approaching university and the professional world.

Therefore, the "tailoring" and "co-designing" of the itineraries are two key concepts integral to the offering. All courses are the product of collaboration between the Ufficio Orientamento and the schools involved, and take into consideration the requests, interests, aspirations and potential of each individual.

On an organisational level, the offering is considerably varied: individual projects aimed at individual students or projects designed for groups of students from the same school of varied duration (20-120 hours over the course of the year).

Moreover, activities may be conducted in collaboration with the staff lecturer ("projects"), or within the administrative structures and various services of the University e.g. offices, management offices or libraries ("pathways").

Given the investment made by the university in the sector and the innovativeness of the offering, over time it became desirable to monitor and evaluate the activities in order to continually increase the quality of the provision and identify any necessary improvements in a timely fashion.

2.2. Description of the methodology

The desire to investigate the quality of the experiences at the University launched a joint study by CeRiForm (Centre for Studies and Research on Education Policy) and the *Ufficio Orientamento*, surveying the perceptions of the schools involved.

The report will focus on the *alternanza scuola-lavoro* activities held at the Milan campus during the academic year 2017/18. In particular, from the distribution of an on-line questionnaire (June-July 2018) to the contact teachers in each school, information was collected in the following areas:

- Quality of the experience (planning, organisation and outcome)
- The usefulness, effectiveness and sustainability of the collaboration between the University and schools in co-designing the programme
- Student satisfaction
- Strong and weak points to emerge from the evaluation phase

These dimensions were investigated using a four-level scale: very positive (++), positive (+), negative (-), very negative (--).

The valid questionnaires represent 44 out of the 53 schools participating in the projects/pathways, or 83%. Below are some of the key findings to emerge from the survey.

2.3. Presentation of the data

The schools that completed the questionnaire had mostly participated in projects with the direct involvement of university lecturers ("projects" 61%), around a third had been involved in the pathways in administrative departments ("pathways" 30%), whilst a small number (9%) had participated in both.

The number of participating students from each school varies somewhat, but is generally limited. In just over a quarter of cases (27%) only 1 or 2 students participated per school; 3-9 students in 23% of cases; 10-19 in 20% of cases and 20 or more in 30% of remaining cases. The limited number of students is a positive indicator, confirming the choice to encourage the tailoring of activities and make it possible to provide each student with

individual support. Nevertheless, for individual schools, this decision has the onerous implication of forcing them to collaborate with numerous institutions.

On a general level, the experiences are widely appreciated (fig. 1), as demonstrated by the nearly exclusive allocation of positive levels on the scale. Schools are either very satisfied (++70.4%) or satisfied (+27.3%) with the organisation, planning (++65.9%; +34.1%) and educational impact on students (++63.6%; +36.4%).
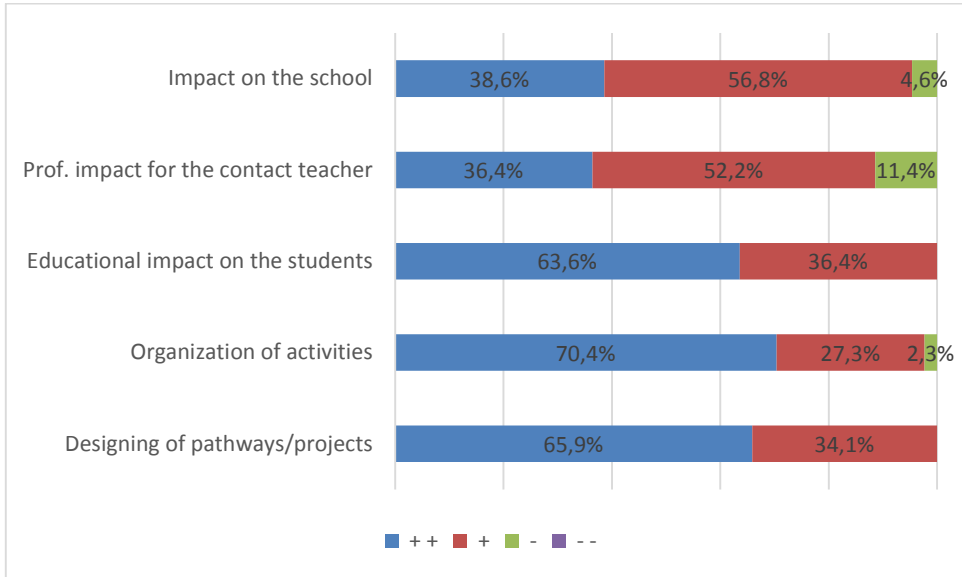
Figure 1. The quality of the experience.

The decision to co-construct the pathways/projects is seen as particularly favourable by schools (fig. 2). In particular, there is distinct recognition of value in terms of usefulness (++ 68.2%; + 31.8%), effectiveness (++ 61.4%; + 34.1%; - 4.5%) and, to a lesser degree, sustainability (++ 42.2%; + 52.3%; - 4.5%). Given the limited number of students participating in ASL at UCSC, it is clear that schools appreciate the decision to engage each individual student in designing their pathway/project, acknowledging the educational value whilst also noting the complexity and labour-intensive nature of this approach.

Most schools surveyed student satisfaction (41 out of 44) with significant results (fig. 3): schools report that students say they are very satisfied (++70.8%) or satisfied (+ 26.8%), with only one not fully satisfied response (-2.4%). In 3 out of 4 schools, a meeting between the *alternanza* contacts at the school and the University contacts to evaluate the projects/pathways and plan future activities had already taken place or was scheduled at the time of the survey.
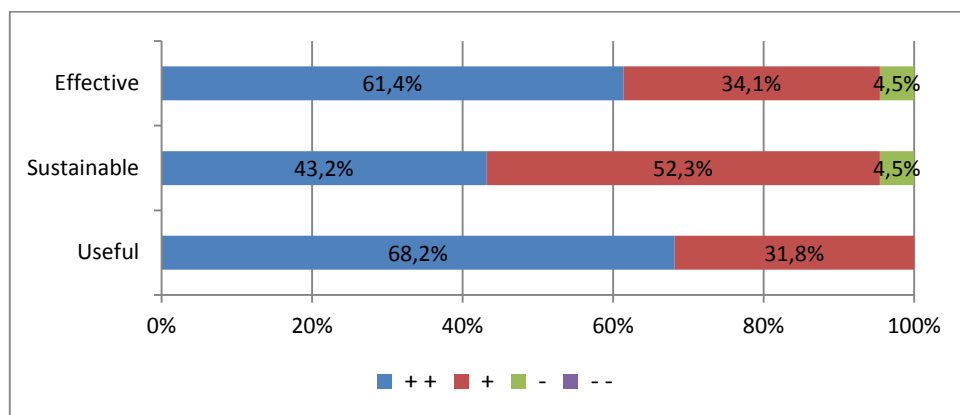
Figure 2. The co-designing approach.
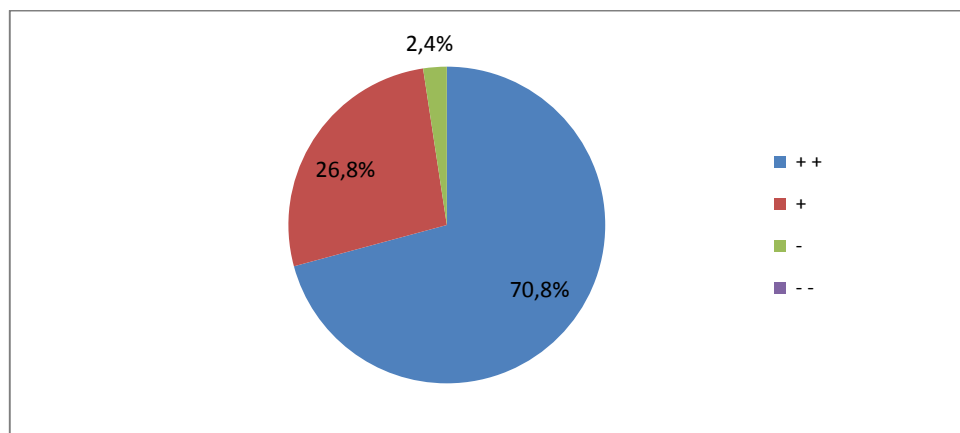
Figure 3. Student satisfaction

3. Areas for development

The *alternanza* offered by UCSC seems to correspond well with a pedagogical approach centred on the following: the central position of the individual, the integrated nature of knowledge and the cultural and educational importance of practical activity (Sandrone, 2016). Whilst the study confirms the satisfaction of the participating schools, from the perspective of ongoing improvement, a number of areas for development emerged in relation to evaluation in particular (Sandal, Smith & Wangensteen, 2014). Indeed, this survey questioned the school contact teachers for the *alternanza* project and, consequently, the ideas expressed reflect only one point of view. In future years, it may be useful to investigate the points of view of all individuals concerned more closely: firstly, the students, who are acknowledged as competent individuals entitled to opinions on their

educational experiences (Grion & Cook-Sather, 2013), but also the company tutors i.e. the individuals (administrative and/or academic) who directly supported the students, to achieve a deeper and fuller understanding of the experiences and identify ways to continually improve them.

Beyond the experience itself, universities should consider *alternanza* a major topic for consideration, since it incorporates the three fundamental pillars of research, education and the third mission.

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Creative writing and Critical Thinking Enhancement at Higher Education

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Abstract

Currently, educational policy makers identify Critical Thinking (CT) as an essential driver for development and knowledge growth in any field and in the broad society. Peer interactions and writing activities are helpful pedagogical strategies for CT enhancement especially when supported by the use of technologies (Guiller, Durndell, & Ross, 2008).

Starting from the above-mentioned evidence, a university module was designed by combining collaborative and creative writing sessions based on critical analysis of literary texts and the fruition of figurative arts. 123 students worked in groups and their CT level was assessed at different times of the course. Most of the students' groups showed an increase of their CT level. The difficulties in the management of group dynamics corresponded to CT level decreasing. On the contrary, groups able to organize their work improved their CT throughout the course. Additionally, students' work modes had an impact on their performance at different CT tasks. The research results could be used to improve university course design for CT education.

Keywords: Creative writing; Critical thinking; Collaborative learning.

1. Introduction and state of the art

Educational policy makers identify Critical Thinking (CT) as an essential driver for progress and knowledge growth in any field and in the broad society. However, CT is still a disputed concept with several different definitions that come from many approaches. CT is commonly defined as "purposeful, self-regulatory judgment that results in interpretation, analysis, evaluation, and inference, as well as explanations of the considerations on which that judgment is based" according to the definition produced in the Delphi Report (Facione, 1990) that is partially affected by the philosophical tradition related to CT definition. Although those perspectives on CT refer to an individual working on his own on a problem based task, recent perspectives suggest that CT may evolve thanks to the important role it could play in *various types of information exchange or symbolic interaction* (Byrnes & Dunbar, 2014). Much of our knowledge of the world comes from others, rather than being the result of primary experience, and requires an analysis and critical evaluation of sources, internal coherence and relation to other sources of information. Also Kuhn (1991) emphasizes the social element in his definition of CT as a type of reasoned argument. The social element in Kuhn refers to the articulation and discussion of ideas with peers who are engaged in a collaborative process of knowledge building. Language skills are important precursors for all high-level thought processes. By regulating thoughts through internal speech and navigating social situations through external speech, language help people process information at increasingly sophisticated levels over time, providing foundation to be engaged in CT. According to Graff (2008), being engaged in a dialogic argument provides the "missing interlocutor" that gives a purpose to the written argument. Peer interactions also provide an opportunity to gain experience or practice in CT, specifically through understanding others' perspectives and creating and fulfilling joint goals (Murphy, Rowe, Ramani & Silverman, 2014). Recent studies have highlighted how technology could be implemented in collaborative learning settings in order to enhance CT (Schindler, & Burkholder 2014). One potential advantage of computer-mediated discussion is its asynchronous nature, allowing more time for reflection before responding. An increase in the use of formal, evidence-based reasoning and the quality of CT can be due to an extension of the time available to think and consult sources of information. In a well-known study of Newman Webb, and Cochrane (1995) they found similar level of students' CT in the online and face-to-face discussion whereas other authors show (Guiller, Durndell, & Ross, 2008) evidence of increased CT level in the online situation, especially in terms of justification. Not only dialogical and collaborative activities seem to affect positively CT, but also other forms of communication, such as individual writing. Quitadamo and Kurtz (2007) compared CT level of students who participated in a laboratory writing treatment with those who experienced traditional quiz-based laboratory in a general education biology course. They found that, unlike the nonwriting group, writing group significantly improved

CT skills, in particular, analysis and inference skills. Kuhn and Crowell (2011) suggested to combine dialogical activities with the use of the individual essay in order to assess the transfer of skills from the social to the individual level. Also Ennis (1993) suggests the adoption of short essay items for assessment purposes because it would capture more effectively the disposition aspect of CT compared to what multiple-choice items formats would do. However, in a 2004 study (Condon, & Kelly-Riley, 2004) it was found that the better the writing, the lower the CT score. According to the authors, the lack of relationship between writing and CT scores indicates that having students write does not automatically mean that we ask students to think critically. They assert that writing acts as a vehicle for CT, but writing is not itself CT. For example, if writing tasks call for summary and fact reporting, there is no reason to suspect that students' performances will incorporate CT. For this reason, it is necessary to carefully design new writing tasks to support CT in education. In a recent study, Snodgrass (2011) found that combining a wiki with in-class activities can facilitate collaboration among students to enhance their learning of the complex CT reasoning skill .

In the present research, we tried to adopt different design lines that could support CT development at higher education level. More specifically, collaborative and creative writing were combined with the critical analysis of literature texts and the fruition of figurative arts. These choices were based on the assumption that discourse between peers during a collaborative writing activity could expose them to peers' thinking processes, understanding that there are multiple ways to approach a situation and learning to reconcile different viewpoints and perspectives, which are all central components of CT. In addition, especially in the area of museum education, CT is often associated with Visual Thinking: watching and enjoying a work of art, comparing different artworks, artists, styles, and trends, allows the audience to develop their thinking, analysis and evaluation skills (Housen, 2002).

2. Module design

The six month university module here presented is a blended learning course in Educational Research Methodology based at the Department of Education. Students attend classes face-to-face and they also interact on"Formonline", a Moodle platform provided by the University of Roma Tre. During the course, students were invited to use analytical and evaluative skills through the analysis of three short stories written by different authors and based on the works by Edward Hopper ("In Sunlight or in Shadow. Stories inspired by the Paintings of Edward Hopper", Block L., 2016). At this stage, students worked in classroom collaboratively, comparing their ideas and writing their answers following a template provided by the teacher. Following collaborative creative writing was carried out on a piece of art of their choice. Students used the Moodle wiki tool to write their creative stories. In

addition, students attended online video lecturing on the "Émile. Ou de l'éducation." written by Rousseau and they were required to write comments on each video and compare their reflection with peers. Students are also required to complete two different kinds of CT pre-test and post-test. At the beginning and at the end of the course they have to write: a) a short essay after reading an excerpt from "The Dialogue Concerning the Two Chief World Systems" written by Galileo Galilei and b) an argumentative map, inspired by the Van Gelder's model (2002).

3. Data collection and data analysis

The present research tried to answer the following research questions:

1. Which levels of CT students' groups showed throughout the course?
2. Which kind of group dynamics students reported in relation to the collaborative writing activities?

First year students from the Educational Research Methodology course were involved. 123 students participated in all the activities (F = 115; M = 8; Average age = 23) and they were organized in 17 groups (about 7 students per group). Three different kinds of data were collected.

1. Collaborative analysis of literature texts: in the first three tasks, students answered guiding questions about literary texts assigned by the teacher.
2. Collaborative and creative text: in the fourth task named "Wiki – Narrating the Museum" students created a story based on a piece of art of their choice.
3. Self-reflection questionnaire: at the end of the writing activities, students were invited to answer a questionnaire that investigated the group dynamics and processes;

The following table (Tab. 1) shows the distribution of the writing activities assigned to the students starting from the beginning of the course (Task 1) to the end (Task 4).

Table 1- The distribution of the writing activities from the beginning of the course (Task 1) to the end (Task 4).

Task 1	Task 2	Task 3	Task 4
Blue Night	The Music Room	Automat	Wiki – Narrating the museum

Different kinds of analysis were carried out in order to investigate 1) students' groups CT level and 2) group dynamics (see table 2). Group dynamics were studied by applying a thematic analysis of the qualitative data collected through the online questionnaire. Each

group of students' CT level was assessed by using two different grids developed in previous research paths (Poce 2011; Poce, Corcione & Iovine, 2012) on the four collaborative texts: *Blue Night*, *The Music Room*, *Automat*, and Wiki – Narrating the Museum.

The first grid contains five macro-categories: 1. relevance of the topic 2. content 3. form and expression 4. originality and creativity 5. use of the language. For each macro-category a score from 0 to 10 has been assigned. Four independent evaluators read the groups' texts and assigned scores on the five macro-categories. At the end, the average of the four evaluators' scores was calculated.

The second grid contains six macro-categories: 1. basic linguistic skills 2. justification 3. relevance 4. importance, 5. critical evaluation 6. novelty. For each macro-category a score from 0 to 5 has been assigned. Two independent evaluators read the groups' texts and assigned scores on the six macro-categories. At the end, the average of the two evaluators' scores was calculated.

Table 2 A description of data collection and data analysis methods

Data collection	Data analysis	Purpose of the analysis
1. Collaborative analysis of literature text 2. Wiki - Collaborative and creative text	Content analysis: - Grid 1 - Grid 2	Assess the level of students' CT
Self-reflection questionnaire.	Thematic analysis	Understanding students' groups dynamics

4. Results

a) *Students' groups CT levels showed throughout the course*

The following image (Figure 1) shows the development of the CT average scores achieved on the four collaborative writing tasks by all the groups. CT average score achieved in the last activity "Wiki – Narrating the museum" is visibly higher (6,75/10) than in the three former tasks (about 6,3/10). However, this difference is not statistically significant.
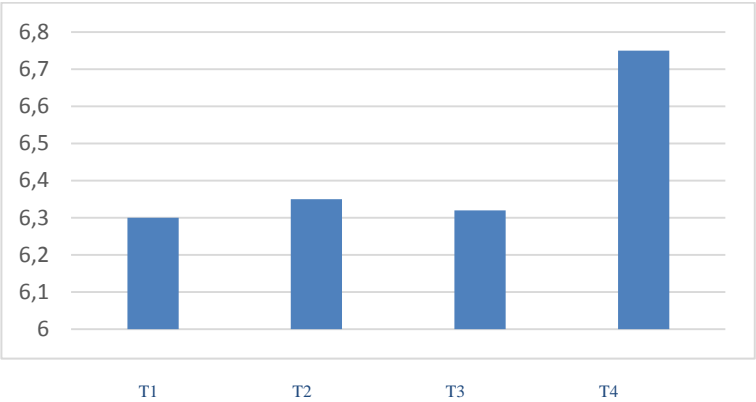
Figure 1 Comparison among the first (Blue night), the second (The Music Room), the third (Automat), and the fourth group (Wiki – Narrating the museum) tasks.

By observing the development for each group, the absence of a common trend throughout the course activity (see as an example the figure 2) can be noticed.
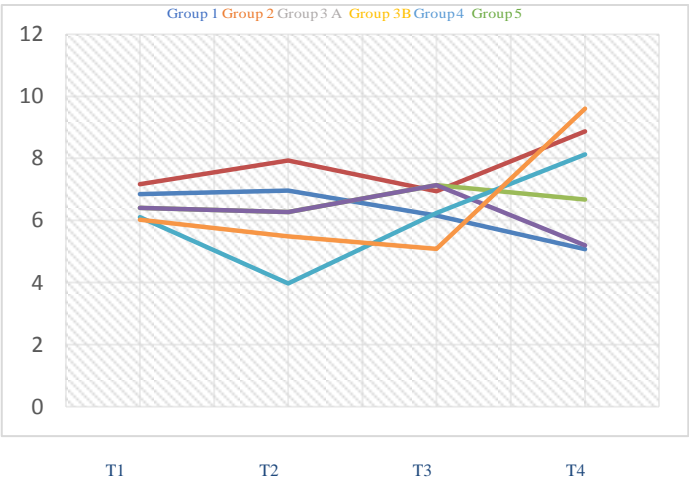
Figure 2 Group cluster results.

Five trends were identified. Three groups tend to increase their average throughout the module's tasks (e.g. group 2), three groups maintain a steady performance (e.g. 3A), five groups decrease their average scores (e.g. group 1), four groups dip and go up (e.g. group 4) and only two groups seem to improve their average scores and then plunge.

Table 3 Groups trend throughout the course's tasks

	Increment	Steady trend	Decrement	Go up and dip	Dip and go up
Groups	2, 5, 16	3A, 6, 17	1; 12; 8; 19; 15	3B, 14	4, 9, 11, 13
Total	3	3	5	2	4

It should be noticed that group 3 split into two different groups in the last activity (3A and 3B) and this could explain the different trend of the groups. Despite the different tendencies, seven groups in the final activity showed a higher level of CT comparing to the beginning. Three groups did not vary their performance whilst seven seem to decrease their CT level.

b) *Students group dynamics in collaborative writing activities*

It was observed that the groups that showed decrement or steady trends in CT scores, reported also difficulties in managing group dynamics. On the other hand, they also recognised the positive aspects of team working, especially in terms of creativity, like in the following extract (E1):

Extract 1 "*Working closely, each of us has been able to see any shortcomings of the other members in different writing fields. Unfortunately, this is one of the disadvantages of not writing individually because you cannot set a medium-high level of writing if not all members are able to support it. I really appreciated the level of our group in the originality field. We worked and collaborated a lot on the plot in order not to make it boring and this is one of the positive aspects of group work because probably by working individually we would not have achieved the same result.*" (Group 8 – Trend "decrement").

Groups that showed an icrease of their CT level throughout the module, reported a higher awareness of the processes needed to organize cooperative work, such as role taking and the use of different technologies to support collaboration. For instance, group 16 described a clear assignment of roles which included the group coordinator, the curator of the narrative technique, the dialogue, the descriptive technique, the spelling editor, and so on.

Opposite preferences were detected in groups that went up and then dipped comparing to the groups that dipped and eventually went up in terms of CT scores. The formers, indeed, found the tasks realised in the classroom more motivating compared to the wiki activity, that was mainly conducted at distance (E2).

E2 "*Certainly the group has been more cohesive and participatory in the class activity, losing the motivation at the time of writing the wiki story. In my opinion, this is due to a rather approximate organization at the time of the roles' division for the writing of the wiki story*." Group 14 – Trend "Go up and dip"

On the contrary, groups that dipped and had a higher score in the last activity were more committed with the creative and collaborative activity of the wiki and some of them reported a strong feeling of ownership, like in the following extract (E3).

E3 *"I think that ech of us can be considered a true author of story as a whole because we all discussed together every single word of it. It took us a very long time, but in the end, each of us was satisfied with the result".* Group 4 - Trend "Dip and go up"

5. Discussion and conclusion

CT development is a pivotal competence to be developed in the higher education system. Rather than be understood just in terms of the individual ability of reasoning, CT is rooted in dialogical and social activities. Through the use of the language, ideas can be explicated and negotiated. For this reason, individual and collaborative writing activities offer opportunities for students to adopt CT in their studies both in synchronous and asynchronous contexts. In the present research, different kinds of collaborative and writing activities were combined to improve students CT.The small dimension of the activity does not allow any generalisation and the results provide an in-depth description of the students' learning and collaborative processes. Groups of students with difficulties in managing their group were not able to improve their CT scores throughout the course. If more skilled in team-working students seemed to increase CT skills. Different trends in CT scores corresponded to different preferences in modalities of collaboration. Some groups preferred the analytical tasks realised in the classroom whilst others preferred the creative work realised with the support of digital technologies. From our perspective, CT is rooted in the ability to work individually and to interact with peers through different kinds of languabe based acts. Collaborative writing tasks need to be carefully designed to support students' CT development, by considering the challenges that students may face. In a further study different kinds of tools could be used. Another aspect which emerged during the study is related to the gender gap which suggests to replicate the activity in different evironments where equal gender presence is represented.

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Teaching Music Historical Literacy Using Video Clips

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Abstract

Four professionally-created, student-presented, three- to five-minute videos were integrated into two undergraduate music history courses at the University of Auckland, to support the development of key historical literacy skills. These include crucial skills and understandings that music students need to master in their first two years: identifying different kinds of music scores; understanding the difference between primary and secondary sources for music historical topics; finding one's way around critical, "complete works" editions of music; and finding and assessing music-related literature on the Internet. The intervention led to marked improvements in student learning in each of the four areas.

Keywords: history pedagogy; student-based learning; music history; literacy; online learning; video clips.

1. Introduction

Educators in historical disciplines at the tertiary level need to rethink how they enable all students to become critical beings. For instance, second-year music history students at the University of Auckland surveyed in 2012-2014 tended to view music history as established fact and had great difficulty posing complex, critical questions and constructing critical, evidence-based arguments about history. History teachers have given much attention to historical literacy in various disciplines, especially at the secondary level, but much of the research is devoted to "content-area literacy" (for example Broomhead, 2005; Shanahan & Shanahan, 2008; Damico & Baildon, 2011). Recent research targets and explores the role of secondary school research projects in motivating students to develop disciplinary expertise in history (for example Sheehan, Hunter & Howson, 2013). However, it is not until tertiary level that learners usually first encounter sharply divided discourse communities in the various academic disciplines. Isolated studies touch on discrete aspects of information literacy in music history (Christensen, Conor, & Ritter, 2018). But to date, no study has specifically addressed teaching and learning a set of basic historical literacy skills in undergraduate music history.

This project was to create and integrate video clips into the teaching of undergraduate music courses in order to support the development of key historical literacy skills for music students. These include crucial skills and understandings that music students need to master in their first two years:

- identifying different kinds of music scores;

- understanding the difference between primary and secondary sources for music historical topics;

- finding one's way around a critical, "complete works" editions of music; and

- finding and assessing music-related literature on the Internet.

This project aimed to develop these four literacy skills by integrating into music history courses four professionally-created, student-presented, three- to five-minute video clips on each of these topics. We took this approach based on our previous research that demonstrates high levels of online usage and digital literacy, and an affinity for student-centred, student-created learning scenarios among recent music students (November, 2011; November & Day, 2012). The key skills were chosen by identifying particular problems students have had in previous years in first- and second-year music history courses.

2. Background and motivation

The integration of modern teaching and modern resources within academia has been met with some resistance over the last three decades. Fear of loss of traditional academic literacy has been a stumbling block for the progress, inclusiveness, and relevance of tertiary institutions in today's world. Recent research has found, though, that information literacy learning in particular can be greatly assisted through digital media such as online courses and instructional videos (Renon, Pychyl, & Motz, 2008; Tewell, 2010; Wyant, 2013). Video has proven to be a particularly effective method of delivering course content, especially when specifically designed for that purpose (Martin & Martin, 2015).

However, in the field of music history, there has been an especially slow shift in perceptions regarding the use of digital and online teaching techniques and resources. This is perhaps because until very recently many of the key research resources, including several important music reference works and archive catalogues, were only available in hard copy. First-hand inspection of rare and fragile manuscripts still remains an important research step for musicologists.

Teaching basic music history skills by means of videos provides a useful way forward. Not only can these videos engage students repeatedly, when and where they choose to watch them, but they also allow for a level of learning that is socially and generationally relevant. As well as delivering information, videos can play an important role in embedding that information: they help students to make sense of new ideas and to create connections between pre-existing schema and any new content being delivered. By combining traditional course content with new modes of delivery, educators are able to bridge the gap between traditional instruction and modern learning, thus promoting meaningful learning, and life-long learning skills (Karppinen, 2005).

3. Method

In designing the sequence of four videos we noted that only a handful of public online resources fulfil a function similar to that which we intend for ours, and none of these use students as presenters. We surveyed twenty-two videos relating to music historical literacy skills acquisition at the tertiary level. These ranged over nine topics, the most popular of which were plagiarism and referencing (two videos); using music research data bases (two videos); identifying and finding journal articles (three videos); and finding scores (ten videos). All are publicly available on YouTube. The videos are fairly homogenous in style, mostly using a voiceover narration to a PowerPoint-like presentation. They were largely produced using screenshots, and the presenter is a music librarian or scholar. A typical example is that from Schenectady Country Community College's Begley Library, entitled

"Finding Music Scores". The video uses voiceover narration with walkthrough-style demonstrative slides (https://libguides.sunysccc.edu/begleylibrary).

For comparison we surveyed six of the numerous non-music-specific online videos, and found more engaging examples, using cartoon figures, video demonstrations, and even background music (for example, the Charles Sturt University "Quick Library FAQs": https://www.youtube.com/watch?v=Nfpu6DHkVQo).

Most of the video clips we surveyed were under five minutes long. Exceptions include comprehensive videos from the University of Denver Music Library on navigating collected critical score editions with *New Grove Dictionary of Music and Musicians* (https://www.youtube.com/watch?v=TZSKrf-ojf0&t=20s), and on using music research databases (https://www.youtube.com/watch?v=n-Dclz9eres). Both are narrated, in the style of a lecture with demonstrative slides. Each is around thirty minutes long.

We sought to create resources that would be much more engaging that anything currently available publicly for students learning music historical literacy skills. We aimed to create resources that students would want to watch repeatedly, for learning and enjoyment. Our project drew in particular on the work of Cook *et al.* (Cook, Bingham, Reid, & Wang, 2015; Cook, Reid, & Wang, 2013), which shows that two- to three-minute, student-centred clips are the most effective type of online visual media for reaching target audiences of undergraduate learners. These researchers' experience suggested to us that we should embed the clips within appropriate supporting materials online, scaffolding their use appropriately within each course. We also drew on the work of Dreon, Kerper, & Landis (2011), who describe digital storytelling as "the art of combining narrative with digital media such as images, sound, and video to create a short story" (5). Such short stories are an effective mode of communicating content to today's learners, who are familiar with the narrative modes prevalent in the media and popular culture today. Todays' students are often highly digitally literate. So teachers can make use of digital media to communicate course content effectively while promoting critical thinking about, and engagement with, the learning tasks.

We undertook a five-step process to create the videos: we sought ethics approval to carry out the project (since it involved some of our own students, and would potentially be released to the public); we auditioned to find suitable School of Music student and staff "talent" to act in the videos; we produced suitable scripts, in consultation with students and professionals in Media Productions at the University of Auckland; we shot the videos over a period of one week; and then we reviewed and edited the videos.

Each clip showcased music students' talents as presenters and performers; and in each one, two students engage in dialogue with each other and with music staff. Each clip tells those two students' story of exploration in relation to the given music historical literacy skill.

In order to integrate the videos into courses, we designed appropriate supporting materials including written transcripts, practical examples, and links to related literature and other videos; we then embedded the clips within a specially designed assignment sequence in CourseBuilder, the University of Auckland's online learning platform: Hibbert (2014) has shown that instructional videos with high numbers of views are often those that are directly connected to course assignments or course assessments. We trialled the clips in a music course for advanced undergraduates, a history-based course entitled "The Symphony", which was run in 2017 (see Figure 1). Then, in 2018, we used the clips in a second-year music history course entitled "Music, History, and Ideas".
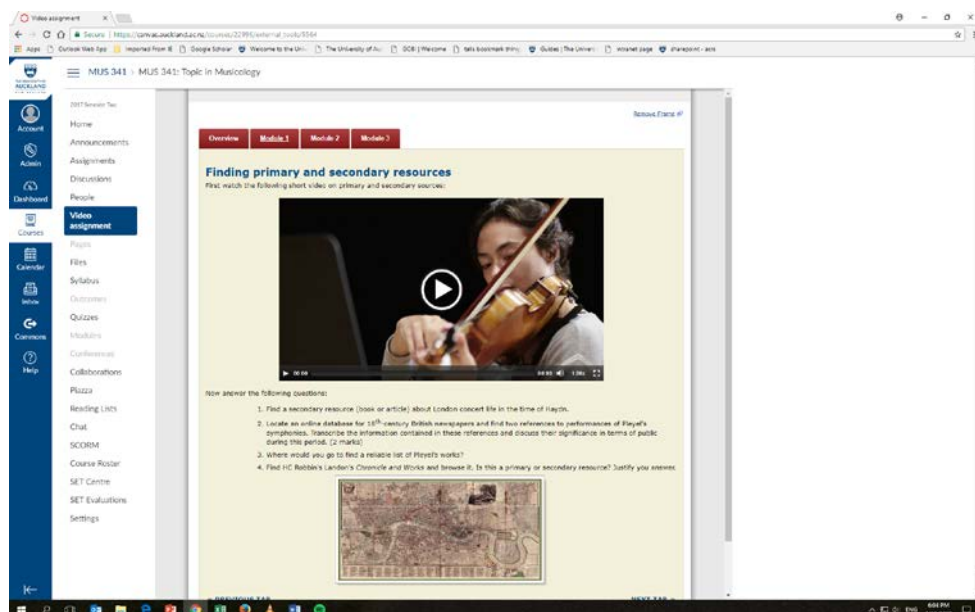
Figure 1. An example of a video clip embedded within the CourseBuilder website for "The Symphony"

4. Results and conclusions

After each course we carried out focus groups with students to help us to evaluate the videos and the CourseBuilder framework. In "Music, History, and Ideas" in 2018, we also carried out "before" and "after" surveys (n = 26 and 24, respectively) to ascertain which tasks students perceive to be the most difficult in relation to music historical literacy learning, and which teaching strategies they found most helpful in accomplishing these tasks. The "before" surveys took the form of anonymous questionnaires in which the students were asked to define terms such as "critical edition", "primary and secondary resource", and asked how they would assess a given online resource. After the students had completed the online modules, in which they watched each video in turn and answered questions about each, they

were once again assessed on their understanding in each of these areas. A further evaluative questionnaire, delivered at the end of the 2018 course, comprised a list of fifteen short-answer and open-ended questions. These were designed to show how students rated the videos in terms of various parameters: length, depth, use of humour, clarity of main message, helpful and unhelpful aspects, and so forth.

The most striking data were as follows:

Before the working with the videos

- 31% of students in the course had trouble knowing how to assess online resources for music history;

- 50% of students could not define a "primary" or "secondary" resource for writing a music history essay;

- 92% of students could not define a "critical edition of music";

- 100% of students could not name or briefly describe any other kinds of musical edition.

After the working with the videos

- 80% of students in could define a "primary" or "secondary" resource for writing a music history essay;

- 73% of students in could define and discuss a "critical edition of music";

- 72% of students in could name and briefly describe other kinds of musical edition.

The project has as its central aim the development of students' historical literacy skills in an innovative way, building on their digital literacy skills. This aim is in line with the graduate attributes of critical thinking and global citizenship that are advocated in recent literature on historical literacy. Nokes (2011), for instance, has argued that the purpose of developing "historical literacy" is to produce students who are "able to negotiate and create the complex texts of the Information Age" (6). This project used video and online instruction to help achieve this aim effectively, efficiently, and accessibly, as follows:

4.1. Effective e-learning

Music students are among the highest users of online resources at the University of Auckland, and they show high levels of digital literacy. This situation is likely to be similar at other large, diverse tertiary institutions. The CourseBuilder environment in which the videos were embedded was designed to further develop students' digital literacy and foster independent thinking, especially through question prompts that were designed to test their learning from the videos, and to test whether they could apply the knowledge in relevant situations.

4.2. Efficient literacy learning and teaching

Teaching music historical literacy skills has traditionally involved library tutorials and in-class library sessions. This involves specialist staff, and takes time away from the teaching and learning of other key concepts and course content. In the past, Music Library staff found that they were frequently approached by students with basic questions regarding these skills, especially as essay and assignment deadlines approached. In this project we created an online resource that students can revisit as often as they need.

4.3. Accessible learning

The video clips were developed in consultation with students, and in creating them we drew on student and teacher talent. In focus groups, students told us that they greatly appreciated seeing their peers on film and in familiar situations. The feelings of familiarity and proximity helped them to see the relevance of the learning tasks and helped them to relate to the material. Students repeatedly commented that they enjoyed the element of humour in the videos, as well as the musical performances. Although these aspects were an aside from the main material, they helped greatly with engagement in and the enjoyment of what might otherwise have been perceived as dry or even irrelevant material.

But could a less resource-consuming means of delivering the same material lead to similar learning outcomes? Yes, quite possibly. In the questionnaire delivered at the end of "Music, History, and Ideas" in 2018, twenty-one out of the twenty-four survey respondents responded "yes" to the question: "Would you be happy to view less 'professional' videos if the topics and content were useful, e.g., student-created videos?" It was notable that five students qualified their responses to this question, one observing that the quality would need to be good, and four emphasising that the content would need to be relevant. The use of student-created videos for subject-specific literacy learning is a subject for future research.

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Teaching essential graduate attributes via digital cultural heritage: An assessment model

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Abstract

Through building the first digital archive about communication education history and cultural heritage in Greater China and using oral history approach involving current students and sharing from alumni, faculty, and staff over the past 50 years, this exploratory study aims to evaluate the effectiveness of using such an inside-out approach to enhance the impact on learning among students as well as cognitive and affective changes toward attaining graduate attributes in the communication profession. Students from six selected courses (N=97) participated in this project completed an online survey. Four instructors and 20 interview participants provided qualitative feedback via email. Hierarchical regression results showed that personal involvement, evaluation of interview sharing, and evaluation of teaching methods were all the significant predictors of the variance in impact on learning as well as cognitive and affective changes toward attaining graduate attributes in the communication profession. Instructors found this approach an effective way to strengthen teaching and enhance students' learning experience from understanding the central, enduring, and distinctive features of communication school and the university. Alumni also believed that this project enabled current students to observe the important graduate attributes which lead to career success.

Keywords: Digital cultural heritage; Graduate attributes; Impact on learning; Oral history.

1. Introduction

1.1. Background

> "To discover something new we must study the old. To invent the future we must understand the past." ~ TS Eliot

Most academic administrators strongly believe that students and alumni are the most important assets of an education institution's growth and outcomes of efforts. Very often educators use an outside-in approach to design programs and activities to enhance teaching and learning such as an industry sharing talk in a big classroom, a firm visit to a creative agency, and an overseas study tour to visit a university and company. Very few of these initiatives, however, look at how to further develop students' learning experience from understanding the central, enduring, and distinctive features of their own schools and/or universities. Learning about the core teaching beliefs and values from school heritage is crucial to help current students recognize and acquire important qualities of graduates.

To prepare students to be responsible global citizens, a local university in Hong Kong identifies seven areas to develop all aspects of the whole person education—citizenship, knowledge, learning, skills, creativity, communication, and teamwork. In celebration of the 50th anniversary of its communication school, an "inside-out" approach was used to teach these essential graduate attributes to current students through building a digital cultural heritage project about the School (COMM).

1.2. Specific aims

While digital heritage has been used in many community projects, our project is the first among communication schools in Greater China about its own education history and cultural heritage. By involving students to study the past, and using oral history shared by alumni, faculty, and staff on the past 50 years' school development, this exploratory study aims to evaluate the effectiveness of using such an inside-out approach to enhance the impact on learning among students as well as cognitive and affective changes toward attaining graduate attributes in the communication profession.

2. Literature Review

2.1. Digital heritage

Digital heritage is the use of digital media in the service of preserving cultural or natural heritage (Cameron & Kenderdine, 2007; Kalay, Kvan, & Affleck, 2007). The Charter on the Preservation of Digital Heritage of UNESCO defines digital heritage as embracing "cultural, educational, scientific and administrative resources, as well as technical, legal,

medical and other kinds of information created digitally, or converted into digital form from existing analogue resources." (UNESCO, 2003). Professor Sarah Kenderdine shared her view on digital heritage in a TED talk: "If we treat the past as a dynamic entity, it's future is vital. And I believe that sensory, social, and democratic experiences of heritage allow us to imagine the future better."

2.2. Oral history and cultural heritage

Adopting the Golden Circle model (Sinek, 2009), we integrated with an oral history approach to allow students to discover WHY—the purpose, cause, and belief of COMM's education heritage, culture, and values through the sharing stories of participating alumni, faculty, and staff across different periods of the COMM history. "Oral history tells us not just what people did, but what they wanted to do, what they believed they were doing, what they now think they did… Subjectivity is as much the business of history is the more visible 'facts' (Portelli, 1998)." Through the use of storytelling, students can learn about how COMM's teaching and learning equipped the graduates with the essential qualities and inspired them to develop their successful careers in the industry profession.

2.3. Study framework

Bloom's taxonomy (1956) on cognitive process dimensions include remember, understand, apply, analyze, evaluate, and create. Some scholars also argued that fostering students' emotional commitment to understanding their own disciplines (e.g. accounting and public relations industry) is equally important (Bay & Felton, 2012; Mak & Hutton, 2014). Hence, we integrated both aspects as study framework to evaluate our project. The framework proposes that there will be positive correlation between learning impact in class and each of the following: (1) a student's personal involvement with the interview sharing (e.g. whether the interview evoked emotions), (2) the student's evaluation of the interview sharing (e.g. whether the interview was memorable and thought provoking), and (3) the student's evaluation of the instructor's methods. In turn, it is expected that self-perceived learning outcomes will be positively correlated with cognitive and affective changes, such as greater awareness and appreciation of attaining graduate attributes in the profession.

2.4. Hypotheses

H1: Students' personal involvement in interview sharing is positively associated with self-perceived learning outcome.

H2: Students' evaluation of the interview sharing is positively correlated with self-perceived learning outcome.

H3: Students' evaluation of the teaching methods is positively correlated with self-perceived learning outcome.

H4: Students' self-perceived learning outcome is positively associated with cognitive and affective changes about attaining graduate attributes in the communication profession.

3. Methods

3.1. Student sample and course design

This two-year teaching development project is expected to recruit over 250 students from various communication disciplines (e.g. advertising, film production, journalism, and public relations) of a local university in Hong Kong to participate. Six courses (N=183) were selected in the first year, including Public Relations Writing, Advanced Writing for Professional Communication, Broadcast Journalism and Cinematic Storytelling. Students, in groups of three to five, were assigned to interview one to three alumni, faculty, or staff in small groups. To allow students to take ownership in this project, they were encouraged to use different formats (e.g. news reporting, feature articles, social media videos, and photography) and styles of presentation (text, visual, audio, and/or video) to present the stories and contribute to the digital archive system.

Students were required to study the background of the interviewee(s) and prepare questions about 1) how their school life looked like in the old days; 2) how COMM's teaching and learning equipped graduates with the essential qualities and inspired them to develop their successful careers in the industry; and 3) advice to current COMM students in their study and career development. Through the use of oral history and storytelling, students were able to learn and cherish the COMM teaching values and embrace the learning culture that lead COMM graduates to become successful communication professionals. Students were also able to showcase and publish their work about the graduate attributes shared by alumni, faculty, and staff in the digital archive portal developed by the university library and on Facebook page for community engagement.

3.2. Data collection

Students in four classes were invited to complete an online survey (N=127) toward the end of the course which took approximately ten minutes. A pretest was done and consent was obtained. We received 97 completed responses which generated 76.4% response rate. The sample included more female students ($n = 77$) than male students ($n = 20$). There was a range from year 2 to year 4 students, with year 3 students representing the highest proportion of the total sample ($n = 70$). We also invited four instructors and randomly selected 20 alumni to provide some feedback about this teaching exercise via email.

3.3. Measures

The survey items used in the questionnaire were partially adopted and modified from assessment models on using films as teaching resource to enhance learning outcomes (Bay & Felton's 2012; Mak & Hutton, 2014). Respondents were asked to indicate their agreement on statements on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*) of the following measures.

Personal Involvement. Participants rated their agreement on six statements about their perceived personal involvement in the interview sharing of the project. The sample items are "The interview made me feel more interested in COMM education history" and "I enjoyed the assignment based on the interview sharing." All responses of six items were averaged to measure participants' personal involvement in interview sharing ($\alpha = .92$, $M = 3.71$, $SD = 0.77$).

Evaluation of the interview sharing. Six statements were used to assess participants' evaluation of the interview sharing. These items included "The selected interviewee was inspiring" and "The interview sharing provided me with meaningful lessons or stories about COMM education." We averaged all six responses into one item to measure participants' evaluation of the interview sharing ($\alpha = .91$, $M = 3.89$, $SD = 0.70$).

Evaluation of teaching methods. Respondents were asked to evaluate the teaching methods through the project by indicating their agreement on five statements. The sample items are "The project briefly helps me understand the purpose of this project better" and "Instructor and project client's suggestions in doing the project help me understand the project better." All responses to five items were averaged into one item to measure participants' evaluation of teaching methods ($\alpha = .90$, $M = 3.74$, $SD = 0.74$).

Impact on learning. Participants were asked to evaluate their perception in relation to impact of engaging in interview sharing on their learning by responding to eight statements. The sample items are "Learning about the student life of graduates makes me feel more interested in the COMM discipline" and "Learning about the student life of graduates makes me better understand what graduate attributes I need to attain to join the COMM industry". We averaged responses of eight items into one item to gauge participants' perceived impact of interview sharing on learning ($\alpha = .94$, $M = 3.82$, $SD = 0.69$).

Cognitive and affective changes. This variable was assessed by five items regarding to graduate attributes (GAs) and Whole Person Education (WPE). For instance, respondents were asked to indicate their agreement on the question like "I have a greater understanding of GAs and WPE than I did before doing this project" and "I intend to learn more knowledge concerning GAs and WPE related to the COMM profession in the future". We averaged responses of five items into one item to measure participants' cognitive and affective changes about attaining graduate attributes ($\alpha = .94$, $M = 3.53$, $SD = 0.80$).

Graduate attributes. The operationalized definitions of the seven graduate attributes are as follows: (1) Citizenship: Be responsible citizens with an international outlook and a sense of ethics and civility; (2) Knowledge: Have up-to-date, in-depth knowledge of an academic specialty, as well as a broad range of cultural and general knowledge; (3): Learning: Be independent, lifelong learners with an open mind and an inquiring spirit; (4) Skills: Have the necessary information literacy and IT skills, as well as numerical and problem-solving skills, to function effectively in work and everyday life; (5) Creativity: Be able to think critically and creatively; (6) Communication: Have trilingual and biliterate competence in English and Chinese, and the ability to articulate ideas clearly and coherently; and (7) Teamwork: Be ready to serve, lead and work in a team, and to pursue a healthy lifestyle

3.4. Analytical methods

A factor analysis was conducted to determine the structure and relationship of items under variables among various groups, which can help to create a more parsimonious model by combining the items under same structure and eliminating irrelevant items. To examine H1, H2 and H3, we used hierarchical linear regression with impact on learning as dependent variable with personal involvement, evaluation of the interview sharing, and evaluation of teaching methods as independent variables. In the model, gender and education level were treated as control variables. To examine H4, a regression with cognitive and affective changes about attaining graduate attributes as dependent variable and impact on learning as independent variable. Gender and year of study were also controlled in this model. For the open-ended question of students' learning experience and feedback from course instructors and participating alumni, we analyzed their inputs and categorized into different themes with some supporting usable quotes.

4. Results

4.1. Survey results analysis

The results of factor analysis revealed that items of each variable can be reduced into one single factor. Thus, this study used the original items as measures for further analysis. H1 predicted a positive relationship between personal involvement in interview sharing with self-perceived learning impact. The results showed that personal involvement was significantly associated with self-perceived learning impact ($\beta = .14$, $t = 2.32$, $p < 0.5$). Thus, H1 was supported. H2 predicted a positive relationship between evaluation of the interview sharing with self-perceived learning impact. The results showed a significant association between evaluation of the interview sharing with impact on learning ($\beta = .48$, $t = 6.60$, $p < .001$). H2 was accordingly supported. H3 predicted a positive relationship between evaluation of teaching methods with self-perceived learning impact. The results

indicated that evaluation of teaching methods can significantly predict perceived impact on learning ($\beta = .38$, $t = 5.44$, $p < .001$). Consequently, H3 was supported by the data. H4 predicted a positive relationship between impact on learning with cognitive and affective changes about attaining graduate attributes. The results showed that impact on learning was significantly related to cognitive and affective changes about attaining graduate attributes ($\beta = .73$, $t = 10.46$, $p < .001$).

Table 1 presents the results of two waves of hierarchical regressions. It revealed that personal involvement, evaluation of the interview sharing, and evaluation of teaching methods all were the significant predictors of the variance in impact on learning. Upon controlling gender and year of study, these three variables explained 82.1 percent of the variance in impact on learning ($R^2 = .821$, $F = 89.340$, $p < .001$). In the model of the regression between impact on learning and cognitive and affective changes, impact on learning explained a 53.8 percent of the variance in cognitive and affective changes ($R^2_{change} = .538$, $F = 38.315$, $p < .001$).

4.2. Qualitative feedback on impact of learning

All students taking part in the project survey gave very positive answers. Their responses about the impact of learning were categorized as:

- They have a better understanding of the COMM history, development, and core values;
- They learned from the interviewees the important graduate attributes they need to acquire in order to excel in the communication industry;
- They have a better understanding of the communication industry, and opportunities they could grasp, and direction they should follow; and
- They were able to acquire practical skills and techniques such as interviewing, feature writing, photo taking, and video production.

Students treasured the valuable experience of meeting with alumni; many of the interviewees are renowned professionals in the communication field. They learned about the importance of holding positive attitude in learning, be proactive, and resilient in study and work. Some of their feedback included:

- "After the interview, I know more about our School, the attributes of alumni and what makes COMM students so different from others";
- "I got more understanding about graduate attributes, whole person education by the concrete experience examples shared by the alumni";
- "I learned so much from the interview. It's just like reading a human book on how the teaching of the School has shaped the alumna into the person she is now";

- "The most important quality of being a communication professional is the attitude. I believe the success of the alumna is related to her attitude"; and
- "I appreciate this interview opportunity which let me know much more about the history of the School. I was also inspired to find more meaning of what I am learning and have a clearer direction of what I am going to do in future."

Feedback from involved instructors and alumni was also very positive. Instructors found this inside-out approach an effective way to strengthen teaching and was able to enhance students' learning experience from understanding the central, enduring, and distinctive features of COMM and the university. A female instructor explained, "it is more effective to let students learn about the essential graduate attributes to become professional communicators in the industry through interview sharing from alumni. Learning from a role model is more impactful than classroom teaching." Participating alumni commented that effectiveness of the Project was two-folded. It helped reconnect alumni to COMM and current students and enhance their knowledge and understanding about recent happenings of COMM. It also gave them opportunities to contribute back to COMM whenever possible. Second, the project helped strengthen students' networking with the industry, broaden their perspective, and enhance their understanding of the history and development of COMM and observe the important graduate attributes which lead to career success. An alumnus commented, "It's very meaningful because it enabled current students to learn more about the history and development of COMM and understand that attitudes, both at work and study, of alumni in the old days." In the long run, it will help to inspire their career development and contribution to the industry.

5. Discussion

While still rather exploratory in nature, quantitative and qualitative findings of this study both suggest strongly that teaching essential graduate attributes via oral history sharing is an effective means of enhancing self-perceived impact of learning among communication students and having positive cognitive and affective changes regarding graduate attributes in the communication profession. In particular, the cognitive processes (Bloom, 1956) as well as emotional attachment (Bay & Felton, 2012) are equally important to transform and sustain the core teaching and learning values from the digital cultural heritage project of COMM. Educators often face the challenges of teaching such "soft skills" while communication professionals often emphasize that these are the most important attributes that communication students should be taught in school, even far more vital than learning the practical skills before joining the industry.

Through small group interaction in interviewing sharing about the old school days, associating school heritage with essential graduate attributes can be easily observed and

applied by students when completing the project assignment. This serves as the first step as many participating alumni keep in touch with the involved students and some even offered internships after the exercise. Acquiring essential graduate attributes can be further developed through networking with role models in the communication profession beyond classroom setting. In the long run, using this inside-out approach of re-connecting alumni with current students can also sustain the core values and cultural heritage of school, regardless of disciplines, to remind students why they are here for (education) and how to become they want to be (successful professionals).

Table 1. Hierarchical regressions to the impact on learning and cognitive and affective changes

	Impact on learning		Cognitive and affective changes	
	β	t	β	t
Block 1				
Gender	-.05	-1.03	-.06	-0.56
Year of study	-.08	-1.90	-.15	-1.44
	$R^2_{change} = .011$		$R^2_{change} = .027$	
Block 2				
Personal involvement	.15*	2.32	-	-
Evaluation of the interview sharing	.48***	6.60	-	-
Evaluation of teaching methods	.38***	5.44	-	-
Impact on learning	-	-	.73***	10.46
	$R^2_{change} = .820***$		$R^2_{change} = .526***$	
Total adjusted R^2	.821***		.538***	

Note: β is the final standardized beta. *p < .05, **p < .01, ***p ≤ .001.

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Art-based methods: Theatre Teaches and Business Theatre

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Abstract

The paper aims to investigate the use of arts in teaching, specifically the art of theater, to provide the new skills searched from the job market. Our work compares the two experiences of the Theatre Teaches performed at University of Brescia and of Business Theatre at University of Catania. The idea of the paper is based on the scientific collaboration among the two co-authors involved, during the last 10 years, on the development of innovative method of teaching focused on non- technical skills. After depicting the incumbent needs of non-technical skills searched from the job market, the comparison on the use of theatre in the two Universities highlighted how both methods support the development of relational, cognitive and managerial soft skills, even if in a different way: when using Theatre Teaches the major skills concern the cognitive ones, while when using Business Theatre the major skills concern the relational ones. Furthermore, it emerges that Theatre Teaches is more effective with cognitive engagement while Business Theatre with emotional engagement. Both are effective in the behavioral engagement (i.e. physical participation in an activity), which emerges as the distinctive characteristic of theatre art-based method.

Keywords: Art-based methods; Theatre; Soft Skills; Economic, managerial and engineering education.

1. Introduction

The fourth industrial revolution together with the worldwide competitiveness are changing the way we work asking for professionals who have skills such as flexibility, creativity. spirit of collaboration and adaptation, ability to understand, communicate and learn quickly. In the era of artificial intelligence, the managers should be able to turn the complicated into simple, to find effective solutions for different problems and to communicate creatively how, where and when the solutions identified must be put into practice. The widespread idea is that the technical skills can be learned, but these may have a limited impact on competitiveness and business results if the company does not have managers who know how to motivate their teams, who effectively communicate and who are able to listen. The future belongs to companies that hold the best technology and technical knowledge together with managers and employees characterized by cognitive, methodological and interpersonal skills (Yunus and Li, 2005).

These considerations seem to revive the role of the University whose purpose is not only to provide technical knowledge, but to transfer a method to solve new and different problems. Numerous studies have raised serious concerns about widening the gap between graduate skills and the needs of the job market in an increasingly globalized society (Mourshed and Patel, 2014). Same concern is found in the European 2020 Strategy and in the opinion of many employers and policy-makers as recently reported by the European Center for the Development of Professional Training.

As such, the paper aims to investigate the use of arts in teaching (named in the literature as A*rts-based methods*), specifically the art of the theater, to provide the new and aforementioned skills searched from the job market.

2. Arts-based methods

Arts-based methods aim to teach through mechanisms in which the use of art reach hidden knowledge that are difficult to achieve through logic and simple rational thought. According to Adler (2006), art helps to broaden the vision of real problem and this implies the acquisition of many different non-technical skills.

The training methods based on the art can pursue objectives and achieve different results also depending on the environments and contexts in which they are implemented. Some of the most emblematic situation in which these techniques were used are:

- *Virginia Commowealth University*: theatrical lessons are given to doctors so that they acquire new skills that enhance their clinical empathy (Dow *et al.* 2007);

- *LEGO company in Denmark*: entrepreneurial strategies are represented through three-dimensional constructions creatively using the famous Lego bricks (Roos *et al.* 2004);
- *U.S. Army leaders*: leaders of the US Army show the film "Sky of Fire" to illustrate the key elements of leadership (Bognar, 1998);
- *MBA students at Babson College*: art history classes are held to improve their creativity (Pinard and Allio, 2005).

These are some examples, certainly not exhaustive, but which show different experiences widespread in the world where traditional teaching methods merge with innovative artistic experimental techniques.

Using the review carried out by Taylor and Ladkin (2009) it is possible to distinguish four different methods of training using arts.

The first one is the *Transfer of Skills*. Starting from the learning of selected artistic skills, the aim is to transfer what achieved to business organizational contexts. Music, theater or dance can create different abilities like taking advantage from mistakes, how to improvise, have full control of the surrounding space. Then arts allow you to develop skills that can easily be relocated in the workplace (Eisner, 2002).

The second method is the *Projective Technique* and it is based on the Freudian projection theory. Projection is a mechanism that involves moving one's feelings or characteristics onto other objects or people. This theory was presented for the first time by Freud in 1896. In the field of managerial training, this activity can be explained in three different ways. The first through the presentation to the subjects involved of some images, specially constituted in an ambiguous way, such as to arouse visual stimuli that give rise to different interpretations on which can be discussed in groups. The other modality contemplates the creation of objects that materially represent the ideas inherent to the company dynamics. The latter, called Imagination Lab, is a technique that aims to express concepts that could hardly emerge through the use of simple words, the idea is comparable to the drafting of the company strategy through the use of Lego bricks.

The third tool is the *Illustration of the Essence*, which is based on fundamentals similar to previous technique. This method aims to make managers able to recreate a shared culture within the company. Various artistic forms can be used, including theater and cinema. By adopting this technique, individuals facing a same theatrical representation focus their attention on different aspects. This is also true inside a team in the business in which individuals present heterogeneous ideas. The ability acquired through this tool consists, while taking into account the various visions, although divergent, to spread in the working environment the sharing of a single mission.

The fourth and last method analyzed is the *Manufacturing*, which is based on the concept shared by the biologist Ellen Dissanayake (2015), that the human brain has evolved through the learning of manual skills. These activities are poorly developed in the modern human due to the presence of industrialized products and technology. So, in this case, art becomes a means by which one can continue to develop its own brain skills. "Doing" implies a mental effort that activates the right hemisphere where intuition and creativity are located, elements that are fundamental in the process of forming new managers.

3. The theatre as tool of non teckinical skill training: the case of the University of Brescia and Catania

3.1. The experience at University of Brescia: Theatre Teaches

Theatre Teaches is a new Arts-base method carried out at the University of Brescia for the first time in the academic year 2014-2015 (Bannò et al., 2018) by Professor in Industrial Economic at the Department of Mechanical and Industrial Engineering Mariasole Bannò and the Actor and Author Andrea Albertini. During the course it is asked students to write a play using topics seen in class and get him to scene. Not to be confused to Business Theatre, this method is applicable in any framework. In the first phase, but only after the Professor carried out the more traditional part of the teaching, Actor, teachers and students attempted to know each other without the typical first-meeting-embarrassment, also experiencing to remove mental oxidations typical of our individual society, such as halfway gestures, voices that can't be heard, etc. After this fist liberating phase, the Actor illustrated the characteristics of theatrical techniques, then the students were allowed to self-select into groups of 7 to 10 people and wrote a script, dealing with directing, with the description of the characters, the creation of movements within the stage space, the choice of furnishings and costumes, lights and music. The added value of this theatrical exercise was the writing of an original script by students, as the result of their ideas and fantasy (Amaral et al. 2017; Pfeifferet et al. 2017). The script was then given a more institutional scenic form by the Actor, then it has become a real play where the actors and technicians were the same students that wrote the play (Senje, 2017). All pieces have been performed in one of the most important theatres in the city, under the patronage of the municipality, where two thousand spectators attend the entertainment.

Figure 1. Theatre Teaches, Professor and students, University of Brescia (2018).

Figure 2. Theatre Teaches, the spectators, University of Brescia (2018).

Referring to the review carried out by Taylor and Ladkin (2009) it is possible to distinguish all four different methods of training using Theatre Teaches. In particular, *Transfer of Skill* and *Manufacturing* are the most developed ones.

Finally, to analyze the effectiveness of this type of teaching, a simple question was put to the students during the written examination, that was: Why the proposed initiative was more effective than other ones? About 120 interesting answers were collected and analyzed.

3.2. The experience at University of Catania: Business Theatre

Business Theater was born in France and more precisely in Paris in 1980 thank to Michel Fustier. Graduated in literature and philosophy, he was a lecturer, then an expert in management control, head of staff, business consultant and specialist in problems of strategy before founding Business Theater. The dissemination of this theatrical methodology is attributed to Christian Poissoneau, who began to recite scenes related to the company life

placed in their work context with the aim of bringing out not only the elements that the company wanted to communicate but by paying attention to any problems that existed in the organization itself. He founded in Montreal, Canada, in 1984, *Thèâtre à la carte*, a theater company with the aim of proposing his work to business organizations. From Paris was spread to Canada and to many European cities such as Brussels, Barcelona, London, Geneva and in the late 1990s it reached Italy too. A fundamental year was 1991, when the first FITE International Business Theater Festival was established in Nantes. The diffusion for the first time of Business Theater in Italy was attributed to Paolo Vergnani in 1997.

The founding element of this type of training is the different vision of the manager; no longer seen as a simple passive subject, but as an actor protagonist of his work experiences. This method, unlike traditional ones, aims to increase the involvement of the interlocutors by placing their experience in the foreground. The participants are encouraged to reflect on their own behavior, being able to grasp also critical aspects of their character that, probably, if communicated through different channels, would be difficult to be accepted (Pearce and Brady, 2003).

Figure 3. Business Theatre, the students and the coaches, University of Catania (2012)

Business Theatre enters in the classrooms of the University of Catania through the contribution of two professionals: Professor Giorgia Maria D'Allura, Professor of Economics and Business Management at the Department of Economics in Catania and the Actor, Author and Director Antonio Caruso. They tested this method for the first time in the academic year 2011-2012 (D'Allura and Faraci, 2018).

The motivation that led to the adoption of this new teaching technique inside a management course was the difficulty in transferring the complexity of business management to the students. In the traditional economic approach, some components that are considered non-rational are omitted, instead they have a significant impact on the economic and financial results of a company. Economic activity is influenced by a multiplicity of elements such as moods, character of the individuals in the organizations, way of living work and relationships with colleagues or the importance given to values. Therefore, being able to recognize and

know how to manage all these unconscious factors allows the person responsible for the management of the company to act more effectively.

Referring to the review carried out by Taylor and Ladkin (2009), also in this case, it is possible to distinguish all four different methods of training when implementing Business Theatre. In particular, and contrary to Theatre Teaches, *Projective Tecnique* and *Illustration of the Essence* are the most developed ones. Same that in Theatre Teaches experience, in order to analyze the effectiveness of this type of teaching, a simple question was put to the students during the written examination, that was: Why the proposed initiative was more effective than other ones? About 20 complex answers were collected and analyzed.

4. Discussion and Conclusion

A first analysis of responses of the two courses, carried out by simply identifying keywords, in each students' answer, reveals that the students recognize the transversal competences, as positive aspects, in both methods. By analyzing both courses we can accordingly divide the soft skills in three main categories: relational soft skills, cognitive soft skills, managerial soft skills. For each category we identify specific competences that can characterize the two methods (Table 1), even all of them are developed from both methods our elaboration was based on the major relevance of each soft skills to the method.

Table 1. Soft skills according Theatre Teaches and Business Theatre.

Soft Skills	Theatre Teaches	Business Theatre
Relational	communication skills, team-working skills, conflict management skills, public speaking	listen the others, take responsability, consciousness of different point of view, skills acknowledgement, increase self esteem, impersonating
Cognitive	concept better internalized, in dept knowledge, problem solving, creativity, ability to tolerate pressure and stress	descovering new aspect, imagination, ability to manage unforeseen situations
Managerial	leadership skills, negotiating skills and ability to motivate	innovation attitude and entrepreneurial skills

Source: Our elaboration.

By analyzing Table 1, it emerges that the proposed division and the specific characterization in three main categories of the two analyzed methods, well reflects the classification given by following Taylor and Ladkin (2009). When using Theatre Teaches the major skills concern the cognitive ones, while when using Business Theatre the major skills concern the relational ones. According to Kahu (2013), these categories compose the student emotional,

cognitive and behavioral engagement. By comparing the two methods, it emerges that Theatre Teaches is more effective with cognitive engagement as task-specific thinking that a student develops and uses while undertaking in an activity while Business Theatre to emotional engagement students' feelings towards teachers, peers and the course. Both are effective in the behavioral engagement (i.e. physical participation in activities), which emerges as the distinctive characteristic of theatre techniques.

The result of these experiments indicates that there is a significant potential to improve students' competencies through theatre creativity which is developed using both methods, Theatre Teaches and Business Theatre. The comparative analysis shows the validity of these methods in the development of skills and competences that characterize managers (Azouzi and Jarboui, 2013). The revisited theater turns out to be an instrument of elastic formation and with ample possibilities of use.

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Thinking Skills in Problem Solving: Pre-Knowledges

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Abstract

The present article shows the results of a study aimed at evaluating the way in which physics students of first semesters use the thinking skills in problem solving. We speak of pre-knowledge in terms of prior theoretical knowledge of an area of knowledge, in this case it is about identifying pre-knowledge in the case of thinking skills for students who have recently entered higher education. At present, the teaching of thinking skills is considered one of the main characteristics of education for the 21st century. An instrument of ten problems submitted to expert judgment was designed to be applied during the academic semester to the students of electrical physics of two Colombian universities during the years 2016 and 2018. Are evaluated the categories of description, representation, identification of relationships, use of the mathematical model and drawing conclusions for each of the problems.

The results show statistically a very low starting point in the ability to use such skills, and is in turn a reflection element for the design of effective pedagogical strategies in solving problems in physics in higher education.

Keywords: Education; Critical Thinking; Pedagogy; Higher Education.

1. Introduction

The low performance of students in international and national tests in the case of Colombia, as well as the alarming decrease in the number of students accessing engineering careers, are the starting point of the present investigation. The poor academic results of students in areas such as physics and mathematics are reason for the low motivation to access this type of careers, as well as to generate the desertion of the university classrooms.

It is argued that the low capacity to use thinking skills in solving problems in science, which involve an important combination of knowledge, as well as a high level of thinking, is the basis for the problem of low ability to solve problems. Although the need for the use of higher thinking skills in solving problems in science is recognized, the corresponding studies focus more on other aspects of the problem.

Benegas and Villegas (2011) focus, for example on the influence of the type of problems faced by a student of physics, these authors highlight aspects such as the importance of the statement in the context of the resolution of a problem in physics. They focus on the incidence of the statement and its implicit context, differentiating the statements from the end of chapter exercises, versus statements more related to everyday life. They find that the students of the first semesters of the university show poor results when they face statements related to everyday reality, apparently closer to the individual. It should be noted that in this case it focuses more on performance, differentiating the type of end-of-chapter problem from statements of daily life, without taking into account cognitive and thought elements that the student must involve in its solution.

On the other hand, Inzunza and Brincones (2010) carry out a study with students of the University of Alcalá de Henares, where they try to identify the mental processes that students use during the execution of the task of solving physics problems. It is found that the students are not able to make the process explicit, since they tend to be very mechanical, as it seems that they have been previously taught. It is also concluded that students do not develop the complete process taught to solve a problem and tend simply to move towards mathematical calculations. In this case the type of problem situations is directed to problems where it is necessary to use equations to perform mathematical calculations, rather than to analyze them.

Also Guirado, Mazzitelli and Maturano (2013), Guisasola, Ceberio and Zubimendi (2011), Perales (2000), Truyol, Sanjosé and Gangoso (2014) show works related to the resolution of problems, which reiterate from their perspective what is considered one of the main contributions of teaching to the integral formation of the individual. Likewise, Franco,

Almeida and Saíz (2014), Beltrán and Torres (2009), Olivares and Heredia (2012) among others insist on the importance of involving the teaching of critical thinking skills in current

education. However, in the field of physics it is not where more researches are found, and the great majority is focused on the resolution process, its steps and results, it differs substantially from the present study.

Unlike most previous studies, the possibility of identifying pre-knowledge of physics students of the first semesters of university, with regard to thinking skills acquired in their previous stage of secondary education in Colombia, is proposed here. The information obtained aims to identify the reason why a student does not usually perform adequately in the solution of problems in physics in engineering, since it does not possess the elements of thought necessary for it. present work is then oriented to evaluate the way in which physics students of first semesters use the thinking skills in the solution of problems of electrical physics in engineering.

2. Methodology

The present investigation is a mixed investigation (Colas, Buendía & Hernández, 2009). A first quantitative element focuses on the operationalization of problem solving through a licker scale, monitoring the process itself of the solution of each problem by the student, and developing a descriptive statistical analysis that identifies the marked trends. Secondly, the skills that the student uses or not in the solution of each problem are described and analyzed qualitatively, each element of the process is observed in the search of those elements of analysis and thinking skills used in an adequate way by the student.

The work was developed during five consecutive semesters of teaching of electrical physics, in the classrooms of the Technological School Central Technical Institute of Bogotá and the University of La Salle taking a sample of 120 students from the two institutions. As an instrument for gathering information, a test of ten typical electrical physics problems, extracted from traditional texts and submitted to the judgment of experts, professors of the basic sciences of the participating institutions, was used. the pre-knowledge are evaluated in the five categories of description of the scenario where the phenomenon is developed (1), graphic representation of the situation (2), precise identification of the relationships between the variables involved (3), logical use of the mathematical process (4), and finally to reach the conclusions of the process (5). Each of the above items was given a value of one if it appeared in the solution presented by the student, and zero if it did not appear in the process. In this way each student has a range of values for their evaluation from zero to fifty. The test was applied at the end of each semester of the fieldwork, when the students had already accessed the theoretical knowledge necessary for the physical solution of the problem, under the classical teaching methodology.

3. Results

It can be seen from the information collected that the students' performance is very low. In table 1, the results and statistical trends are clear and significant in that they reveal the very low level of the second semester students of the participating universities that were submitted to the test. The mean of the sample is only 20.36 on a total score of 50. It was observed that although some students obtained a score above 25, there were few cases, so that most do not adequately develop the process to solve problems, nor adequately use the thinking skills necessary and implicit in this process, their pre-knowledge in this field can be considered minimal.

Table 1. General description of results

Average	20,3571429
Typical error	1,42815928
Median	20,5
Mode	12
Standard deviation	5,34368272
Variance	28,5549451
Range	18
Minimum	12
Maximum	30

Source: The author (2018)

On the other hand, if the score is analyzed by category, (table # 2) it can be seen that the highest average is that corresponding to the mathematical process, even though it is still a low score. It can be inferred from now on, that the mathematical process is more developed than the analytic process. It is also observed that the lowest score corresponds to the category of the identification of relations between variables. This aspect involves the use of higher order thinking skills.

Table 2: Average Score per Category (120 students)

Category	scenario	graphic	relations	math process	conclusions
Average	3,85	4,23	3,51	5,32	3,45

Second, the most relevant aspect was the observation that students tend to go mechanically to the use of equations, without going through the conceptual analysis, the characterization

of the phenomenon, the theoretical relationships between variables. In this sense, it is further observed that, in most cases, even calculating a numerical data through the equation does not imply developing any degree of analysis and search for meaning, it seems to represent only a hope of having succeeded with a prefixed solution that leads to obtaining a satisfactory rating.

An analysis from the necessary pre-knowledge leads us to consider, in the first place, that the student does not consciously identify the scenario within which the phenomenon is developing, can be terrestrial gravitational field, region in which a magnetic field is present, etc. The student cannot make explicit the conditions imposed by the environment of the phenomenon, even if tacitly recognizes the existence of a phenomenon already predicted by what is discussed in class. Although it identifies the variables involved in the matter, it does so more by the fact that its pre-knowledge guides it towards the fact that it appears in the equation, rather than the fact of observing the consequences in real life. They are not aware, in general, of the consequences involved, neither symmetry and cause-effect issues that would imply similar results in parallel phenomena. He is aware that the equations lead him to a response to certain questions already predesigned, but not with the amplitude of the detailed description of the event, and the possibility of predicting any situation adapted to the parameters of the same.

4. Conclusions

The aspect that the best performance of the studied sample barely reaches 30 points over 50, constitutes proof that the student of first semesters of higher education of engineering careers in Colombia, arrive with very few pre-knowledge needed in the aforementioned to the thinking skills necessary to face challenges such as the solution of problems in physics, the basis for engineering careers, and in turn the basis for the technological development of any country. Very low contextual analysis, low perception of the phenomenon, little analysis of relationships and final consequences of physical laws. It is intuited that the educational process prior to training the student, not to analyze but to find answers, and that most of the evaluation instruments used usually request a number, a data, a specific response, when what should be asked is an analysis, a possibility, a condition. The thinking skills have not been taken into account in the process.

It is concluded that the working hypothesis is true, and that the students do not have the capacity to access the adequate use of their superior thinking skills necessary for the evaluated process. It follows from this that it is necessary to implement methodologies for teaching this type of skills, if you want the level of graduates of engineering careers in Colombia to be enough to face the development challenges of the country, as well as motivate the students and decrease the desertion of the university classrooms in Colombia.

It is proposed as an idea to involve alternative strategies, such as the so-called routines of thought (Marina, 2012), cognitive modifiability (Feuerstein and Feuerstein, 2010), among others, that invite the student to act in a methodical manner, with clear and concise objectives of learning, methodologies that invite, among others, to turn everyday things into a reason for reflection, aspects that are already so common in our environment, that they are no longer a cause for reflection. Understanding that these strategies are clearly transversal to the different areas of knowledge, with the corresponding implications.

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A collaborative game-based learning to enhance ecological economics teaching

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Abstract

Game-based learning refers to the use of game thinking and mechanics to engage and motivate students in the learning process. We applied this innovative concept to complement the theoretical sessions of an introductory course on ecological economics in the Faculty of Economics and Business of the University of the Basque Country (UPV/EHU). A participatory simulation game originally developed by Capellán-Pérez et al. (2019) in the context of energy and sustainability education was adapted for this course and, at the same time, the theoretical sessions were reshaped to enhance the learning experience of the gaming. The pedagogical effect of the course innovation was evaluated with a previous and posterior questionnaire. The results show that this combined strategy is especially suited to motivate and engage students into the discipline of ecological economics, as well as in order to promote team work and collaborative thinking. We also observed that students gained a better global vision and understanding of the interrelation between the topics discussed during the course and a greater capacity to interiorise the global socio-environmental crisis that humanity is currently facing.

Keywords: Game-based learning; Ecological economics.

1. Introduction

Scientific research is increasingly showing that the current socioeconomic system is leading the world towards overshoot and collapse (Rockström et al., 2009; Steffen et al., 2015). Urgent and radical global control measures are needed in order to avoid catastrophic consequences of global warming and the surpass of other planetary boundaries (McGlade and Ekins, 2015; Randers, 2012).

Transiting into a sustainable economic system is a global challenge requiring a substantial change of behaviour and values (especially in increasingly materialised western societies) in order to rescale needs and desires under the limits of the availability of natural resources and ecosystem services. The effectiveness of sustainable policy measures require active collaboration between individuals, regions and political institutions among the world, which emphasises the need to facilitate participants of the course with a deep understanding both of the severity of the problem as well as the complexity of the solutions. In fact, teaching about ecological economics and sustainability is not an easy task given the cognitive difficulties that humans have in understanding the functioning of complex systems.

Faculties of Economics and Business present nowadays a general lack of criticism to the neoclassical paradigm that sustains the current economic system (e.g. the growth imperative), and therefore, very little room is left for alternative approaches like that of ecological economics. In this context, the annual Course on Ecological Economics at the Faculty of Economics and Business of the University of the Basque Country (30-40 students per annum) started as an attempt to include these concepts in the study program. The course was initially conceived as a research-based learning introductory course of 20 hours through an integral learning process for undergraduates, postgraduates and academic staff of any discipline.

In its fifth edition (2018), a gamification strategy was incorporated into the learning process adapting the participatory simulation game Crossroads-World developed by the Group of Energy, Economy and System Dynamics of the University of Valladolid in the context of energy and sustainability education. The game is based on the MEDEAS-World model, a global, state-of-the-art, one-region energy-economy-environment model (or integrated assessment model) designed applying System Dynamics (Capellán-Pérez et al., 2017). System Dynamics has proved to be a particularly well adapted modelling methodology for gamification (Alessi and Kopainsky, 2015).

The aims of this hybrid strategy combining theoretical sessions with gamification were: (1) to provide students with better comprehension of the magnitude and potential consequences of the global environmental crisis; (2) to promote collective reflexive thinking on the topics of the course; (3) to acknowledge the importance of access and critical evaluation of

information and its sources; (4) to implement a multidisciplinary thinking to better understand and interiorise the link between the newly acquired knowledge and the challenges facing in their own lives; and (5) to provide knowledge to assist participants to actively invent and apply solutions in their personal and collective life.

The use of a participatory simulation game was motivated by the need to enhance students' motivation and participation through the experience acquired in practical scenarios with up-to-date scientific methods and data. The game-based learning (GBL) approach also aimed to reinforce their motivation to search imaginative solutions to the environmental problems facing our planet.

2. GBL METHODOLOGY

2.1. Course design

The gaming strategy by means of the Crossroad-World simulation game aimed to promote the active participation of students in the learning process as well as a reflective evaluation of their decision process by successively running the model. The main objetives of the game were twofold (Capellán-Pérez et al., 2019): (1) raising awareness on the severity of the global environmental crisis that humans are facing, and (2) understanding that different approaches may be taken to deal with this issues based on different ethic or ideological standpoints. The game ultimately allowed students to interiorise that our needs (or desires) are limited by biophysical constraints. Consequently, Crossroad-World simulation game was chosen as the backbone of the research-based learning course on ecological economics given its scientific up-to-date state-of-the-art, and being developed consistently with Ecological Economics' main principles.

In order to have a successful adaptation process between the game potential and the objectives of the course, it was necessary to start by defining the pre-requisites and starting conditions for the game. The idea was to lay the groundwork to adapt the game to the topics of the course and, at the same time, adapt the learning activities to the requirements of the game. This way, students could engage and settle the topics discussed in the teaching sessions and relate them to the challenges that climate change and depletion of natural resources represent to human societies which they experience during the game. All these needs were put in common in a workshop among all teachers before the course. The next step was to adapt and simplify the participatory simulation game to the requirements of the introductory course on ecological economics (i.e. modifiable options of the game such as a policy to modify the economic structure through dynamic evolution of the input-output matrix, interface adaptation, group dynamics design, etc.). As mentioned before, the gamification strategy was incorporated transversely to all the topics in the course, so it was also necessary to adapt and develop teaching material based on the requirements of the

simulation game. Specific activities were designed to introduce some specific topics as demanded by the participatory simulation game. These activities were developed in coordination between the teaching staff and the developers of the simulation game following a common structure and nomenclature. In addition to an introductory session presenting the course and the gamification strategy, all the theoretical sessions were oriented to provide with specific inputs to the simulation game that would run in the last session of the course. Table 1 presents the topics covered by the different theoretical sessions of the course.

Table 1. Description of the theoretical sessions of the course on ecological economics.

Day	Duration	Topic	Code
	70 mins	Transition towards a sustainable economy	M1
1	70 mins	Evaluation of the ecosistemic services	M2
	70 mins	Main challenges of climate change	M3
	70 mins	Waste management and transport	M4
2	70 mins	Economy and ecological debt	M5
	70 mins	Sustainable energy transition	M6

2.2. Gaming session

The gaming strategy was organised on a cooperative team-learning process, following the Student Team Learning methodology (Devries and Edwards, 1973). The learning activity was carried out in a final one session by heterogeneous teams searching cooperative learning within groups (among peers). The objective was to compare and discuss in group the level of achievement of the goals of the simulation game among different teams. A facilitator per group helped participants solving their doubts and working with the Crossroads-World graphical interface.

The horizon of the simulations was set in the mid-century (2050-80) following the EU Energy Roadmap (European Commission, 2011) and the IPCC recommendations (IPCC, 2014)). The first step was the constitution of groups. In our case, it was 5 groups with 4-5 members. Once the groups were constituted, participants were invited to select the key hypotheses. Hypotheses are two assumptions (not affected by human decisions) that the simulation game requires as starting point: (H1) future availability of non-renewable energy resources (namely, oil, gas, coal and uranium); and (H2) future climate change impacts.

The third step was to perform a simulation of the extrapolation of current trends as perceived by the participants. The main purpose of this step was to visualize where current

trends could lead us by 2050-2080. In the light of the results obtained, participants could collectively decide to set some desirable targets in terms of an environmental objective (i.e. global average temperature stabilisation, O1) a welfare objective (i.e. using future availability of energy per capita, O2). Objectives could be changed during the game.

Consequently, in the next step, participants started to build alternative scenarios that iteratively allows them to understand the dynamics of complex systems and the ethical dilemmas behind different choices. The first scenario extrapolating current trends serves as basis for comparison of the alternative simulations. To do so, they could define a set of 12 policy targets: (1) Population growth, P1; (2) Planned growth of GDP per capita, P2; (3) evolution of the structure of the world economy, P3; (4) Implementation of a reforestation program to capture CO2, P4; (5) Planned nuclear power capacity, P5; (6) Planned liquid biofuels production, P6; (7) Planned renewable energy capacity for electricy production, P7; (8) Planned renewable energy capacity for heat production, P8; (9) transport system structure, P9; (10) Planned technological change, P10; (11) minerals recycling rate; and (12) evolution of other GHG emissions apart from burning fossil fuels, P12. As previously mentioned, the contextualisation and definition of these hypothesis (H), objectives (O) and policies (P) were covered by the theoretical sessions as presented in Table 2.

Table 2. Relation between sessions and the hypothesis, objectives and policies covered.

Topic	Code	Hypothesis	Objectives	Policies
Transition towards a sustainable economy	M1			P2, P10
Evaluation of the ecosistemic services	M2			P4, P6
Main challenges of climate change	M3	H2	O1	P12
Waste management and transport	M4			P9, P11
Economy and ecological debt	M5			P1, P3
Sustainable energy transition	M6	H1	O2	P5, P6, P7, P8

The final step was a group discussion including all participants from all groups and debriefing of the alternatives simulated by different groups. At this point, each group briefly presented their results, reflections and comments of the simulations that they had run. Finally, a general discussion among participants took place with the assistance of the facilitators. This final step aimed to connect the gaming experience of the participants with the topics discussed during the course. The ultimate purpose of the game (and the system dynamics model behind the game) was to provide participants in the course with strategic planning policy orientations and the ethical dilemmas arising from the evaluation of their feasibility or acceptability.

3. Monitoring and evaluation

In order to assess the monitoring and evaluation of the GBL process, two surveys were developed, one to be passed before the course and the other, right after the game session. Several of the questions appeared in both surveys. Each student was asked to fill each survey with a personal and anonymous code to allow cross-checking and, therefore, comparative analysis of the answers before and after the course.

The first survey consisted of 14 questions, organized in three sections. First, a battery of questions is presented to gather personal information and general opinions on economic related issues. Subsequently, a set of questions on climate change and international climatic policies are presented. The survey ends with some questions on the learning methodology itself. The second questionnaire was also divided into 3 sections, including additional 14 questions in total. In this case, the first section gathers information on the satisfaction level of the students and the eventual influence of the course on them. The second and third sections, maintain the same contents of the initial survey, with identical questions for comparison purposes and others that complement them. For those questions in the survey to be answered by an evaluation scale, a Likert-alike evaluation method was used, with a mark range between a minimum of 6 and a maximum of 10.

4. Results and discussion

From a pedagogical point of view, we aimed at evaluating the clarity of the objectives of the course, the motivation of the students, the interactions between students, and the personal impacts of the contents of the course. In addition, from the point of view of the contents, it was intended to evaluate mainly the information received (quantity and quality) and the extent to which the information received was adapted to the interest of the participants. The final sample consisted of 19 finished pairs of questionnaires (previous and posterior), with 16% males and 84% females, 100% holding degree in higher education and an average age of 31 years old. It must be noted that, although the course is directed to undergraduates, postgraduates and academics, most participants were postgraduate researches and young academics of non-economics disciplines.

The introductory course on ecological economics is a open course so, unsurprisingly, attendees were generally aware of the current environmental crisis. As shown by the analysis of the previous questionnaire, all students felt that climate change will have mainly negative or very negative effects on human well-being if current trends continue. In a 1 to 10 scale, their average concern about global issues was 9. Regarding the evaluation of the gaming strategy, participants were previously asked whether they had any knowledge about innovative teaching methodologies, in general, and game-based learning strategies, in particular. Nearly 80% of the students had previously worked in innovative teaching

environments. All of these students considered that innovative learning methodologies were more motivating and/or influenced their study initiative. However, only 53% of the participants had heard about game-based learning methodologies. Despite this, 100% of the participants considered that the use of the simulation game as a teaching methodology was adequate amd that they had understood its purpose and functioning. Similarly, all participants considered that using a game-based learning methodology was more motivating and/or that it had influenced their study initiative. Crossroads-World obtained excellent results when participants were asked to rate in a 1 to 10 scale if the game had been; understandable (7.90), entertaining (8.74), useful in terms of learning (8.95) and rigorous and objective (8.17).

In the same line of positive evaluations, there is a general agreement that game-based learning facilitates mutual support among peers, contributes to create a sense of team, improves the classroom environment, encourages communication and helps to consolidate the knowledge acquired during the course. Finally, the posterior questionnaire showed that the Crossroads-World simulation game fosters participation and involvement in the course and motivates research on the topics discussed. Furthermore, participants clearly stated that the gaming environment had helped them better understanding the problem and its consequences in comparison with more traditional courses.

5. Conclusions

This paper provides with an application of a gaming strategy as an innovative learning tool, capable of better motivating and engaging students and, at the same time, proving with autonomous, participatory and collaborative learning. The pedagogical effect of the GBL strategy applied to the introductory course on ecological economics was evaluated with a previous and posterior questionnaires.

The GBL methodology has meaningfully improved the learning experience of participants and the results show that gaming strategies can be specially suited for teaching sustainability issues in higher education contexts by: (1) allowing a better comprehension of the magnitude and consequences of the environmental crisis; (2) promoting the reflexive thinking on the topics of the course; (3) acknowledging the importance of access and critical evaluation of information and its sources; and, above all, (4) implementing a multidisciplinary thinking to better understand and interiorise the link between the newly acquired knowledge and the challenges facing in their own lives. All in all, the experience has been found to be very successful by participants and academic staff, and the GBL methodology will be implemented again as a centrepiece in future editions of the introductory course on ecological economics.

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Critical thinking in PBL: Development of a bespoke tool for critical thinking

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Abstract

As an active learning strategy, problem based learning (PBL) puts the emphasis on students being responsible for their learning (Hmelo-Silver and Barrows 2006). Although it is student-centred, PBL facilitators can help students achieve deep learning through strategies which allow them to check their understanding and engage in critical thinking skills. However enabling students to engage in critical thinking skills and assessing their learning requires the use of innovative strategies (Azer et al., 2013). This paper describes the development of a learning tool to allow students undertake their own-self assessment. It was developed on the principles of ill-structured problems which encourage the utilization of critical thinking skills (Kek and Huijser, 2011). Thus the aim of the research was to assess whether the tool would allow the students to engage in critical thinking skills such as deep understanding and application of knowledge. Results show students found the tool to be effective for their learning where they were able to apply their knowledge and test understanding. This suggested that the developed tool proved to be useful in engaging students in critical thinking skills and as a means to check student understanding.

Keywords: PBL; critical thinking; check understanding; facilitation.

1. Introduction

According to Dewey 'critical thinking arises when we are faced with perplexity, confusion or doubt' (Dewey, 1933). So from a educational perspective critical thinking provides a means to seek solutions to problems and encompasses an array of cognitive skills which include analysis, reasoning and evaluation (McPeck, 1981). These skills are situated at the high end of the educational learning objectives in Bloom's taxonomy thus signifying critical thinking as being the apex of effective learning and overall educational attainment (Bloom, 1956).

More specifically, critical thinking is essential in medical education and in empowering medical students to become competent doctors. Be it in the chaotic environment of an emergency or when undertaking complex differential diagnoses, doctors must be able to think critically. It is through drawing on critical thinking can doctors ask the right questions, order the appropriate tests and consider the most effective treatments even if they do not have all the information at hand. Thus in the context of medicine, critical thinking encompasses not only cognitive skills of analyzing, reasoning but also the ability to infer, show diligence and an overall inquisitiveness (Sharples *et al.,* 2017). Putting this into context and in highlighting the importance of critical thinking to medical education a recent study explored the underlying causes of diagnostic errors. The findings were indicative that doctors perceived the problem to be due to lack of critical thinking rather than lack of knowledge (Crosskerry 2013).

PBL is naturally suited in helping students develop critical thinking in medical education. The study of authentic clinical cases allows students to utilize cognitive skills such as analysis and evaluation of information. A major part of PBL also involves students reaching a collective understanding of problems which draws on critical thinking skills such as knowledge application, reasoning and making inferences (Masek and Yamin, 2011). Evaluation of own current PBL format highlighted that students were lacking to effectively show or engage in critical thinking. This was based on the recognition that students were mostly reading out answers from their notes which provided little opportunity to show their understanding or ability to think critically. Thus this paper describes a study which was carried out to explore how a strategy could be developed to allow students to utilize critical thinking skills.

2. Literature review

A literature review was performed to extract a comprehensive understanding of the link between critical thinking and PBL. The literature was searched using the following key words 'critical thinking', and 'critical thinking AND PBL'.

2.1. Situating critical thinking in PBL

PBL is considered to be an active form of learning which engages students to exercise the different domains of Bloom's taxonomy including analysis, evaluation and synthesis of knowledge (Azher *et al.,* 2013). Given that the origins of PBL stems from innovating medical education, it has been identified to improve critical thinking skills i.e. clinical competencies such as reasoning and analytical skills of medical students (Sharples et al., 2017). Recognising the potential of PBL as an effective means of learning, it has been adopted in other fields of education and in real-life situations. For instance it has been reported to be an effective approach for teaching managers develop skills of reasoning, analyzing and evaluation for tackling problems (Carvalho, 2015). Thus it was evident in the literature that PBL offers students scope to develop critical thinking skills, however it was quite clear that despite its implementation, using strategies which enables students to extend into the higher domains of Bloom's taxonomy i.e. application of critical thinking was often overlooked. One major factor underlying this could be that there is no general consensus on the best way to facilitate PBL for effective learning. (Savin-Baden, 2014).

2.2. Inception of critical thinking through ill-structured problems

Several innovations have been reported in the literature as a way to engage students with critical thinking. Activities such as debates can stimulate reasoning and analysis however they can be time consuming which could result in time being taken away from the core classroom time (Crenshaw, 2011). In overcoming this problem, innovations could be designed which students can engage outside classroom time. Exercise based workbooks offer students to work at their pace. The incorporation of problems within the workbooks stimulate an inquisitive approach which is thought to act as mental exercises to develop critical thinking (Crenshaw, 2011). However the extent to which such innovations help students apply the skills of critical thinking has been argued to be influenced by the design of problems. Textbook type of excercises or problems have been found to have no impact on improving students' critical thinking skills (Cotter *et al.*, 2009). A more effective strategy could be the use of ill-structured problems to trigger students to utilize their reasoning, analytical and evaluation skills (Ge and Land, 2003). Ill-structured problems are constructed in a vague manner prompting students to consider all the components of the problem. This acts as a way to help the students make links to concepts and consider them as a whole, which is required for knowledge integration (Torre, 2013). But the important feature of such problems is that they accommodate multiple solutions thus triggering skills such as reasoning, analysis and evaluation.

3. Methods

3.1. Study design and data collection

This study was carried out using an action research approach which offered a collaborative approach to work with colleagues and students in better understanding the problem as well as finding solutions. Three PBL groups consisting of 34 students gave consent to be part of this study. The overall study design involved two cycles each running for two weeks. In each cycle printed matrix customized for the individual PBL week, was given to the students by the respective group's PBL tutor. Answers to the matrix were provided in the second (closing) PBL session. At the end of each cycle an online questionnaire was used to allow students to evaluate their experience of using the matrix and to find out what changes could be made to improve it.

3.2. The principles used in designing the learning matrix

From the literature review ill-structured problems were identified as being effective in developing critical thinking. However the traditional format of textbook styled problems were found to be ineffective for critical thinking which prompted research into seeking alternative format of presenting information and testing understanding. Concepts or information can be presented in a visual way using concept maps which help students visualize relationship between concepts (Torre, 2013). This principle of presenting concepts visually formed the basis on which an innovation was designed for the purpose of this research. In concept maps information is presented in a linear and hierarchic manner however a weakness in such a format is that if too much information is included, the key concepts can be masked as well as cause confusion (Gerdeman, 2013). To overcome these problems, an innovation was devised in a matrix like style to enable information to be expressed in a concise way. However like concept maps, information which convey key or critical information was presented in a minimal manner as follows. Firstly, the concepts were framed under specific headers which act as specific questions or anchors. As this reseach was interested in medical education the innovation was devised to be aligned with the objectives and content of Year 2 curriculum of a MBChB programme (School of Medicine, Keele, UK). Thus the headers were specific to clinical competencies such as scientific knowledge, recognising symptoms and undertaking differential diagnosis which were referred to as "mechanism ", "clinical features" and "diagnosis" within the matrix. Under each of these headers relevant concepts were presented within rows which are associated with different features of diseases. However to make the intervention as an ill-structured problem, the rows had been left partially incomplete thus acting as a puzzle. Represented much like a crossword, the headers act as clues as what information/concepts are needed to fill in the incomplete boxes. To make it challenging rather than a straight fill in the blank type of problem, the concepts given in the learning matrix were carefully selected to create uncertainty and

ambiguity (Figure 1). This was aimed to trigger the students to carefully analyse what they know and use critical thinking skills to come up with the most correct solution.

Mechanism	Clinical features	diagnosis	ILOs (PBL case on anaemia)
		Autoimmune haemolytic anaemia	1. Describe the development and breakdown of RBCs in the normal system.
Overproduction of leukocytes in bone marrow			2. Blood film - what does it look like and what do those terms mean? Types of blood cells. 3. Pathophysiology of haemolytic anaemia.
		Glucose-6-phosphate dehydrogenase (G6PD) deficiency	4. Explain her symptoms. 5. Explain the morphology of the RBCs. 6. Antiglobulin test.

Figure 1. A learning matrix to support students' learning of anaemia related topics. The right panel shows the main ILOs as set by the students for a PBL case themed on anaemia and the learning matrix devised for this is shown on the left panel.

4. Results and discussion

In cycle 1 the matrix was given to the students at the beginning of the second PBL session. It was reasoned that the puzzle like nature of the matrix would be useful for students in testing their understanding. This would encourage group discussions where students could show critical thinking skills such as analysis and reasoning when offering solutions to the matrix. However it was found that very few students attempted to engage with the matrix during the session. A major reason behind this was that students felt they did not have enough time since they were busy discussing their set intended learning outcomes (ILOs) (data not shown). Students also suggested that perhaps it would be more useful to them if they had access to the matrix during the week rather than at the end i.e in the closing session.

This change was implemented in cycle 2 where students had access to the matrix after the first PBL session. Students used the matrix for two consecutive weeks after which their experience of using it for PBL was evaluated. Out of the 34 students, 13 students provided their responses on using the learning matrix. Lack of time was again cited for the low response by some of the students. Nonetheless, from the students who had responded it was clear that they found the learning matrix to be an effective and useful tool for their learning.

Analysing the free-text data for recurring theme on the usefulness of the matrix four main themes emerged as described below.

i). Interlink different concepts: The matrix allowed students to link the different topics and form a summary of the important learning areas as evident from the following responses.

"Allowed me to connect different aspects of learning together".
"Helped me summarise information from pbl".
"Helped to break down large quantities of learning material into concise key points which are important for the case."

The above responses provided indication that students perceived the learning matrix to have a positive impact on their learning. Using only few words the matrix design allowed the tool to be useful in summarising several key concepts. Based on the principles of concept mapping it could be argued that visualising the concepts together helped students to establish how they relate to one another and thus aid their understanding (Torre, 2013).

ii). Test understanding and apply knowledge: The learning matrix was designed as a puzzle. It was anticipated that such a format would evoke the knowledge students had gained in tackling their ILOs and apply their knowledge to "solve" the matrix. In order words, students would be prompted to use reasoning and evaluation skills to identify the missing information of each row and thus complete the matrix. Students perceived this strategy as an effective way to test their own understanding and apply their knowledge as documented by the responses highlighted below.

"I used it at the end of the week to tie up my work and make sure I had covered everything and understood it."
"Helps to test my understanding."
"Helps to guide my understanding of a topic. It ensures I have covered all areas relating to a case. It also gives a baseline level where the whole PBL group should be."
"Useful in pushing us to apply our knowledge."

iii). Identify knowledge gap: Another positive aspect of the learning matrix reported by the students was that it allowed them to identify gaps in their learning. This is evidenced in the student responses below.

"It helped fill gaps in my knowledge."
"Helped point out areas not covered fully."
"It allowed to me to go away and complete by own learning to see if I am able to cover all aspects included in the matrix off my own back. If this has not happened in the week it then allows me to see what I have missed and how to close a case properly, knowing I have covered everything.

This feature of the learning matrix can be attributed to its design which allows key concepts to be visualised by students. Indeed, highlighting important learning areas as concepts or keywords through concept maps have been shown to be an effective way for students to not only assess their understanding but pinpoint areas which they need to improve on (Veronese *et al*., 2013). Thus the matrix could be used by students as a self-diagnostic learning tool as part of their reflective process on improving their learning.

vi) As a revision tool: Extending on the above point students also found the matrix to be a useful study aid which could help in their revision as exemplified by this response:

"I think it will make a useful revision tool as it is a means of collecting and packaging relevant information into a succinct form. The completed matrix can be easily printed off and put up on a wall which will make it useful for glancing at during revision periods."

5. Conclusion

Critical thinking encompasses cognitive skills such as deep understanding, reasoning and application of knowledge. The findings here indicate that the matrix could be a potential tool to support students in developing critical thinking skills. Firstly, students identified it to be effective for their learning since they could assess their understanding and apply the knowledge they had gained. Secondly, the matrix functioned much like a puzzle owing to its innovative design thus allowing the element of gamification to be incorporated into the existing PBL format. Gamification motivates students to learn (Kapp, 2012) and so the matrix could be used to increase student engagement. Thus the matrix could be used as a tool by tutors to improve their practice especially in PBL. Checking students' understanding is an essential part of PBL (Wood, 2003) but where PBL is facilitated by tutors who are non-expert on the learning topics, this can be a challenging issue. The matrix offers a unique approach to test student understanding in a self-regulatory manner. Furthermore, it has the potential to act as an agency in ensuring tutors are able to provide guidance and make PBL effective without having to be content specialist.

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A first experience with Problem-based learning in a course of Psychometrics

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Abstract

The aim of this study was to describe students' perceptions on problem-based learning (PBL) when applied in a course of Psychometrics. 34 students participated in the course. Activities were conducted in groups of three students during two sessions of two hours each, and included the traditional steps in the PBL tutorial process. Participants were surveyed on their perceptions on PBL, acquisition of competences in PBL vs Traditional learning, and will to use PBL methodology in the future. Results pointed that students' perceived PBL could help them to improve group work and problem resolution. Students preferred PBL methodology to acquire responsibility for learning, work with groups and conflicts, acquire a receptive attitude, and skills related to share information and learn from others. Finally, around 60% of the students expressed their will to take more courses (either Psycometrics or other courses) using PBL. These findings are a starting point to use the PBL methodology in other contexts different to the medical education. Specifically for Psychometrics teachers, it is of importance to rely in a methodology that provides students satisfaction, will to repeat, while acquiring the contents of the cours and general competences.

Keywords: Problem-based learning (PBL); Psychometrics; Problem-solving; Group work.

1. Introduction

Problem-based learning (PBL) is increasingly used in multiple disciplines, with its origins in medical education (Savery, 2015). This educational method is fundamentally a student-centered approach to learning, in which teachers present problems or *scenarios* to the students. These problems may provide a context to tap the learning objectives, which either can be course level objectives, or more specific ones (Barrows, 1985; Barrows & Kelson, 1995).

Although there are 'many species and subspecies' of PBL (Barrows, 1986), that is to say, it can be implemented in several ways, most of them share some fundamental characteristics: it is an educational approach whereby the problem is the startingpoint of the learning process; it is a participant-directed learning processes, or 'self-directed learning', which has a far more individual-oriented focus; PBL is a experience learning, where the student builds from his/her own experiences and interests; it is an activity-based learning, requiring activities involving research, decision-making and writing; the solution of the problem can extend beyond traditional subject-related boundaries and methods; and it is a group-based learning, as the majority of the learning process takes place in groups or teams (Barrows, 1996; Kolmos, 1999; van der Vleuten, Norman & de Graaff, 1991).

Among the positive characteristics of PBL, there is the promotion of a positive attitude towards learning, the active and intensive students' participation, the students' search of information to support their hypotheses, and the collaboration between students (Gilbert, 1997). Indeed, authors have pointed several advantages of PBL when compared to traditional, teacher-focused educational methodologies, including activation of prior knowledge, elaboration on newly acquired knowledge, contextual learning, and general problem-solving skills (Dolmans & Schmidt, 1996); improvement of cognitive skills: critical thinking, analysis, synthesis and evaluation, learning concepts and contents of the subject of study with a positive attitude, ability to identify, analyze and solve problems, ability to detect learning needs, manage efficiently different sources of information, understand phenomena of the specific and contextual environment, listen and communicate effectively; participate in the decision-making process, demonstrate security and autonomy in actions, and questioning the proper scale of values: honesty, responsibility and commitment (Mendoza & Bernabeu, 2006). Specifically in the medical education arena, PBL has been found to enhance self-directed learning skills (Norman & Schmidt, 1992), stimulate students to become self-directed learners (Blumberg & Michael, 1992; Schmidt & van der Molen, 2001), improve students satisfaction (Albanese & Mitchell, 1993; Berkson, 1993; Vernon & Blake, 1993), and improve knowledge and clinical performance (Colliver, 2000).

Although there is plenty of evidence of PBL advantages for medical education, empirical evidence in other fields, such as Psychology, is scarce. This is specially true when it comes to those "less clinical" courses of Psychology, such as Statistics or Psychometrics. Indeed, no studies of PBL applications during a course on Psychometrics have been published, as far as we know.

Taking into account this literature review, the aim of this study was to describe students' perceptions on PBL in a course of Psychometrics, gathering both information on which competences are acquired with PBL and also comparing the acquisition of skills in PBL and traditional leraning.

2. Methods

2.1. Design, setting, and procedure

This research was carried out during the introductory course to Psychometrics that Psychology students take during the second year of the Psychology Degree. It is an annual course, of 9 ECTS. The PBL activity was implemented to cover the learning objective of evidence of content validity, which is the first content in the second semester. The specific objectives included were: description of content validity, areas of content validity, methods of estimation of content validity, and main guidelines to guarantee test content validity. The scenario presented to the students was adapted from Santiesteban (2009), as follows:

"*A Psychometrics student is studying for the exam. She puts a lot of effort and dedicates a lot of time to study, because the concepts are interesting for her. Also, she considers them basic to understand many others areas of Psychology.*

Therefore, the student is very interested in obtaining a good mark in the final exam. She is reasonably confident, because although there are topics that she knows better than others, she considers that she has a good general level of knowledge.

After the exam, she is not satisfied with the result: she has failed. Why? She asks. Her personal conditions were excellent to perform on that test. What happened? 'Nothing strange', she says to a classmate, 'I just failed because of the 7 topics on the agenda, they asked me the only one I didn't knew.'

The exam, whose aim was to evaluate the knowledge acquired in the introductory course of Psychometrics, focused only on one of the contents of the program. Was it a good test? Did it correctly measure the basic knowledge of Psychometrics? Were the exam contents biased? How can we make sure we have a good exam?"

The different activities were conducted in groups of three students during two sessions of two hours each. Activities included the traditional steps in the PBL tutorial process: (1)

identify and clarify unfamiliar terms presented in the scenario; (2) define the problem to be discussed; (3) "brainstorming" to discuss the problem, suggesting hypothetical explanations based on prior knowledge; identify areas of incomplete knowledge; th one member of the group records all the discussion; (4) review steps 2 and 3 and arrange explanations into tentative solutions; one member of the group organises the explanations and restructures if necessary; (5) formulate learning objectives; tutor ensures learning objectives are achievable, comprehensive, and appropriate; (6) private study and information gather to each learning objective; and (7) group shares results of private study; tutor checks learning; assessment (Wood, 2003).

After the two sessions, an online survey was conducted using SurveyMonkey®. It took approximately five minuts of duration, and participation was informed and consent.

2.2. Participants

34 students participated in the session and completed the survey. Most of them (*N*= 31; 91.2%) were women. Age ranged from 19 to 21 years old. Information on students' achievement on the first semester of the Psychometrics course can be consulted in Table 1.

Table 1. Marks on the first semester of the course of Psychometrics.

Variable	Mean	Standard Deviation	Minimum score	Maximum score
Activities	15.73	1.33	12.00	17.00
Exam mark	7.69	1.61	3.13	10.00

Source: Own elaboration. Notes: Students were required 17 activities during the first semester (values ranged from 0 to 17); exam mark could range from 0 to 10, being 5 the minimum score required to pass the exam.

2.3. Variables

Participants were surveyed on several questions, based on previous literature regarding PBL:

- *Perceptions on PBL*. Students had to score, in a five-point Likert-type scale, to what extent they thought the PBL could help them to acquire the following competences: problem resolution, decision making, group work, planification of learning strategies, critical thinking, assessment and self-assessment skills, and permanent learning.
- *PBL vs Traditional learning*. Students were asked to compare the PBL experience with the traditional classes, "in which the teacher explains the contents". They had to chose which methodology was more helpful to acquire a list of competences,

the traditional learning, the PBL, or both equally. The competence list included: take responsibility for learning; work with different groups managing possible conflicts that arise; have a receptive attitude towards the exchange of ideas with colleagues; share information and learn from others; be autonomous in learning (find information, contrast it, understand it, apply it, etc.) and know how to ask for help and guidance when you need it; and have the necessary strategies to plan, control and evaluate the steps you take in your learning

- *Will to use PBL methodology in the future*, either in Psychometrics courses or other subjects.

2.4. Data analyses

Statistical analyses included descriptive statistics. In order to describe the students' perceptions on PBL, mean, standard deviations, and minimum and maximu scores were calculated. For the purpose of comparing traditional learning and PBL, and also to study the will to use PBL methodology in the future, frequencies and percentages were calculated.

3. Results

As reported in Table 2, students' perceived PBL could help them to improve group work and problem resolution quite well, with a mean of almost four points in a five-point scale. The rest of the skills obtained scores in the middle of the scale, around three.

As regards the comparison between PBL and traditional learning, more than two thirds of the students preferred PBL methodology to acquire responsibility for learning, work with groups and conflicts, and acquire a receptive attitude. PBL was also preferred for half the students to work skills related to share information and learn from others, whereas only 5.9% pointed traditional learning for this purpose. Finally, similar results were obtained for traditional leraning and PBL when the skills to acquire were related to autonomous learning and planning and control strategies. More details can be consulted in Table 3.

Finally, regarding the implementation of the PBL methodology in the Psychometrics course and in other subjects, around 60% of the students expressed their will to take more courses (either Psycometrics or other courses) using PBL, as it is shown in Table 4.

Table 2. Students' perceptions of PBL.

Variable	Mean	Standard Deviation	Minimum score	Maximum score
Problem resolution	3.84	0.87	2.00	5.00
Decision making	3.38	0.92	1.00	5.00
Group work	3.93	1.02	2.00	5.00
Planification of learning strategies	3.17	0.93	1.00	5.00
Critical thinking	3.23	1.28	1.00	5.00
Assessment and self-assessment skills	3.08	1.16	1.00	5.00
Permanent learning	2.88	1.17	1.00	5.00

Source: Own elaboration.

Table 3. Comparison of PBL and traditional learning.

Variable	Prefered traditional learning		Both equally		Prefered PBL	
	N	%	N	%	N	%
Take responsibility for learning	7	20.6	4	11.8	23	67.6
Work with groups and conflicts	3	8.8	7	20.6	23	67.6
Receptive attitude	2	5.9	9	26.5	23	67.6
Share information and learning	4	11.8	12	35.3	18	52.9
Autonomous learning	11	32.4	11	32.4	12	35.3
Planning and control strategies	11	32.4	11	32.4	12	35.3

Source: Own elaboration.

Table 4. Will to take more courses with PBL methodology.

Variable	No		Don't mind		Yes	
	N	**%**	**N**	**%**	**N**	**%**
Will you like to use PBL again in the Psychometrics course?	6	17.6	6	17.6	22	64.7
Will you like to use PBL again in different courses of the degree (Personality, Learning Difficulties…)?	7	20.6	7	20.6	20	58.8

Source: Own elaboration.

4. Discussion and conclusion

Although problem-based learning (PBL) is a relatively old educational methodology, most of the studies published had focused on its implementation in medical education. Research on the arena of Psychology is quite limited, and no results on courses related to Statistics or Psychometrics have been found. Because of that, the aim of the current study was to analyze students' perceptions of PBL when applied in a course of Psychometrics.

Results showed that PBL promoted, as perceived by the students, general problem-solving and group work skills, as already pointed by Dolmans and Schmidt (1996) and Mendoza and Bernabeu (2006). However, our evidence did not supported the previous findings that related PBL to better planification of learning strategies, critical thinking, or autonomous learning (Blumberg & Michael, 1992; Norman & Schmidt, 1992; Schmidt & van der Molen, 2001). In fact, when students were asked to compare PBL to traditional learning methodologies, autonomous learning and planning and control strategies were perceived as skills equally acquired with both methodologies, with almost the same amount of students chosing one or other learning methodology. The last PBL issue assessed was willingness to repeat, with more than half of the students expressing their wish to work with this methodology again in the future, either in Psychometrics or in other course of the Degree of Psychology. This could be attributed to the skills acquired, but also could be understood as satisfaction with the methodology, as pointed in previous research in the medical context (Albanese and Mitchell, 1993; Berkson, 1993; Vernon & Blake, 1993).

Although the research has several limitations, including the small sample size and its descriptive nature, the findings are rewarding. Results are a starting point to use the PBL methodology in other contexts, different to the medical and clinical situations we are used to. Specifically for Psychometrics teachers, a mandatory course in the degree of Psychology that is many times approached with disinterst, it is of importance to rely on a methodology that provides students satisfaction, will to repeat, while acquiring the contents of the cours

and general competences. Future research using bigger, more representative samples and studying the relation between the use of the PBL methodology and students' outcomes would be welcomed.

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Students with Learning Disabilities at University

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Abstract

Specific Learning Disorders involve a plurality of functions that impact the decoding of the alphabetic code. They have an evolutionary character, that is, vary according to the age of the subject.

The present work, connected to positive practical experiences, investigates the characteristics of DSAs in adulthood and the impact with university teaching. It presents the outcomes in progress of an interdisciplinary project (including pedagogical, medical and engineering area).

Learning Disabilities (LD) disorder are relatively new for the education at the university level, and have therefore pushed teachers and researcher to define research projects, both scientific and pedagogic, aimed to suit the needs of LD students. In such perspective, due to the high variability of LD manifestations and degrees and also to the peculiar students' features, a multidisciplinary approach and strategies are required to identify personalized educational paths for LD students while respecting, the specificity and the objectives of the different university courses.

Keywords: Learning Disabilities; Inclusive Education; Special Education needs; Didactic tools; University.

1. Premise

This paper refers to an experimental procedure carried out by a research team at the Florence University (ITA).

LD problems are relatively new for the education at the university level, and have therefore pushed teachers and researcher to define research projects, both scientific and pedagogic, aimed to suit the needs of LD students. In such perspective, due to the high variability of LD manifestations and degrees and also to the peculiar students' features, a multidisciplinary approach and strategies are required to identify personalized educational paths for LD students while respecting, the peculiarity and the objectives of the different university courses.

2. Project plan

The Italian national education system, due to the Law 170/2010 "Nuove norme in materia di Disturbi Specifici di Apprendimento in ambito scolastico", have to apply inclusive protocols for student with disabilities. These protocols have to be adopted by schools and universities and encourage the use of teaching methodologies and strategies for students with special needs in order to promote their school success and to ensure the educational processes.

The increasing number of university students with LD is a consequence of the education tutelage promoted by the law 170/2010. As a consequence, there is a need of specific support strategies and personalized teaching models that allows to use compensative tools and assessment modalities, suitable for specific study courses.

The research project "Students with Learning Disabilities at University - Realization of a Protocol for Usability of Teaching and Individual Study" is part of this kind of approach.

The project began in January 2015. Its purpose is to ensure a full application of education law for university students with LD. Its specific objective is to create a teaching-management protocol for the inclusion of students with LD inside the Florence University.

It has been possible to reach this objective thanks to an interdisciplinary approach which offers an integrate view of the object of research, on the perspective of the opportunities and the criticalities. This is the reason why the research team members have different competencies, with pedagogical, sanitary and engineering skills. This allowed, from the early steps of the project, the integration of different observation levels in order to understand and fit the needs of students with LD from several points of view and to develop aimed to the achievement of their welfare within the University path.

2.1. Project phases

During the first step a study of the previous data of students with LD enrolled at the University of Florence and a detailed research on the state of the art have been performed. This step also enabled the research team to create a group of students to be involved in the project in order to better acquire, in a structured manner, their needs and requests.

This project has involved different partners, including various local associations.

At the end of this step, a group of 43 students provided their contacts in order to participate to the project research initiatives.

During the second step a data collection and a student specific needs analysis were performed, thanks to the presentation meeting, an on-line questionnaire for the students and four focus group took place. The results of these steps are presented in the following paragraph.

At the end of the final steps of the Project, the following outcomes will be delivered:

- a University Guide Lines for teachers, university staff and students. It should offer good praxis and indications useful for student's career, educational offer, teaching activities and university services efficiency;
- a web site, which will be part of the institutional University site, built according to the usability and universal design standards, suitable for students with LD. The web site will also be addressed to teachers, university staff and students and should offer information and suggestions about services, requests, assistive materials given by the University to students with LD. In particular, it should help the students from the beginning to the end of their university career and the teachers to have an effective approach with students with LD.

The project is currently in progress. The initial operating phase is concluded, and revision processes are in progress.

3. Tools

3.1. Questionnaire

From the earliest meetings of the working group it arises the idea to submit a questionnaire to students with Learning Disabilities. Starting from the research plan, this kind of entry survey would have permitted us to reach rapidly a wide number of goals:

- to establish a first interaction with students;
- to have an early feedback from students about the actual aims of the project, based on the number and type of the received responses;

- to collect information regarding the personal student's experiences, in order to better organize the following steps of the project;

- to test the students' Learning Disabilities knowledge and awareness, in order to have a future comparison on the same topics at the end of the project;

- to use the questionnaire as a test itself in order to verify, where possible, the layout and contents compliance level.

The survey was titled "Inquiry on students with Learning Disabilities in the University of Florence" and the questions had been grouped in the following sections:

- "Biographical Information", in which information about age, gender, year and kind of university course and other previous educational experiences were requested;

- "Diagnosis and treatment", where the students were asked to indicate the kind of Learning Disabilities, the presence of co-morbidities and the age of the first Learning Disabilities diagnosis;

- "Degree of satisfaction of various aspects of university life", where the students were asked to evaluate different aspects of their university life as burocracy, lessons, entrance test and exams organization, usability of the university web sites, quality of learning material;

- "Relationships inside the University", where the students were asked to evaluate their degree of satisfaction in their relationship with professors, university personnel and other students;

- "Supports available in University", where the students were asked to evaluate the supports provided from the University: the CESPD Learning Disabilities help desk and the tutoring services;

- "Tools and instruments", where the students were asked to evaluate their use frequency of technological tools and software able to support their Learning Disabilities and the degree;

- "Individual strategies", the students were asked to evaluate the efficacy of their personal strategies used to improve the learning;

- "Feedback", the students were asked to give a feedback about the questionnaire itself, starting from their specific issues, giving an assessment of the relevance of the content, the chosen language and the layout.

A total of 24 questions were submitted to participants: mainly multiple-choice ones and, only where necessary, open-ended questions. The aim was to achieve easily grouped and

quantifiable answers, together with examples, motivations and student's personal observations, otherwise undetectable.

For the multiple-choice questions, a four-value Likert scale was used, where the choice of a response with an increasing value always corresponded to more positive item evaluations.

The questionnaire was anonymous and it was submitted online to a chosen group of students with different Learning Disabilities, using an email invitation containing the link to the questionnaire web page, a personal password and some synthetic compilation instructions. Further explanations and clarifications were also provided to students during the first meeting with the research group in which the whole project was presented.

The questions were formulated using, whenever possible, a Learning Disabilities friendly language: short sentences; coordinated sentences rather than subordinate ones; grouped questions for thematic areas; simple vocabulary.

For the same reason, the questionnaire layout was created according to the following rules: large, sans serif fonts; targeted use of capital and bold letters to emphasize the logical structure of the text; alignment of the text to the left; no use of hyphenation; choice of not too contrasting colors for text and background, (no black characters on a white background).

3.2. Questionnaire results

The invitation to participate to the questionnaire was sent to a group of 43 students enrolled at the University of Florence with a learning disability certification. We obtained 26 answers (60% of the total amount).

Analyzing the results, the main critical items are the following:

- the University of Florence web site;

- the online and paper forms;

- the exams and test worksheets.

The degree of satisfaction about the relationship with professors, university personnel and other students is high.

The questionnaire received a positive feedback from the students.

3.3. Focus groups

Once analyzed the results of the questionnaire, the investigations on the needs of students with Learning Disabilities continued by means of four focus groups. The aim was to investigate some of the most critical items perceived as a priority by the students, which, at

the same time, are found to be actually improvable elements during the following steps of the Project. As a result, the following areas of analysis were identified:

- the website of the University: when the students with Learning Disabilities were asked about their degree of satisfaction on various aspects of their university life, it received the lowest mean. The decision to carry out a further study on the website is also linked to the fact that one of the final outcomes of the project will be a DSA-friendly website;

- the relationship with the professors: although judged satisfactory in terms of interpersonal relationships, and in terms of teaching support tools had the higher number of issues in the open-ended responses, the relation with teachers revealed a widespread behavior heterogeneity;

- the teaching support tools: the most relevant results were, surprisingly, not the level of satisfactory use but rather the low level of knowledge and use by the students themselves, in many cases less than 50% of the total students responding to the questionnaire;

- the support services provided by the University: students with Learning Disabilities, often did not know their existence or, in many cases, judged them unsatisfactory.

For collecting data during the focus groups it was decided to use a method typical of the Quality Function Deployment (QFD), a tool originally used for quality management, whose versatility makes it easy to use in a number of different contexts.

Specifically, the used method was a simplified correlation matrix, a grid where, after identifying the customer (in this case the focus group participating students, with the guidance of some moderators) and the critical elements (the so-called VOC, voice of costumer) relating to the scope of analysis, the possible solutions (so-called CTQ, critical to quality) for each VOC are defined. The result is a matrix in which each VOC is associated with one or more CTQ. During the four focus groups, moderators and students have therefore worked in teams to build four correlation matrices, one for each of the chosen areas. The matrix definition was made in real time, using a wide screen to display all the steps.

The time for each focus group was limited to 30 minutes, including introduction, VOC collection and reorganization (to eliminate repetitions, not relevant items, etc.), CTQ collection and final construction of the matrices. Obviously all matrices were further ordered in a more organized way in a subsequent debriefing, exclusively reserved to moderators.

Each focus group was attended by two moderators, two observers and a working group of 8 students.

The analysis of the correlation matrices permitted to better define the following project steps towards some specific items, directly obtained from the CTQ analysis. In particular, the main results could be summarized as follows:

- the legislation alone is not enough to ensure that students with Learning Disabilities a full integration within their university career. The laws must be associated to guidelines and to good practices handbook;

- there is a need to invest in training and information processes, able to "educate" all users to relate properly with each other and with the available educational tools;

- as a consequence, a homogeneous behavior policy has to be promoted in the relationship between teachers and students: teachers and students need to know what they can get one from each other but also what are the limits of their possible requests;

- a website that collects guidelines and good practices handbook is mandatory, it must be structured in several levels of interpretation (for teachers, for students, for the university personnel involved with students) and above all it must be easily usable by the "weaker" users, the students with Learning Disabilities themselves, with ad hoc contents and layout;

- some compensatory easy-to-use instruments must be provided, not affected by a technological obsolescence, which effectively would make them quickly unusable.

4. Conclusions

From the survey questionnaire and focus groups we can already deduce the important considerations for further work, although it is only the half the project.Five years after Law 170/2010 University institutions are not yet fully able to match the educational needs of LD students' study. But even these students aren't sometimes aware of their rights. We need invest in global educational processes at all institutional level in order to spread knowledge about the needs of people with LD in adulthood.

The University has a specific responsibility in this direction, it must have teachers trained, and they have to know the rules and the results of studies with scientific evidence around the theme of LD and their characteristics in adulthood. The teachers have to be able to implement a university teaching LD-friendly and know how to adopt specific protocols to which all students with LD can be accessed directly in the form systematized and not just occasionally and sporadically. This is in fact the purpose of this project.

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Class observations from the University of Hawai'i at Mānoa highlight the need for active learning strategies to support diverse students in large classes

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Abstract

Compelling evidence indicates that "active learning" (learning by doing) is an effective pedagogy regardless of discipline or class size, and can be particularly effective with diverse students. This study investigated active learning practices in 64 classes at the University of Hawai'i at Mānoa, a US university with a highly diverse student body, using a "Passivity Indicator" (PI: ratio of class time spent in passive activities to total class time). For all classes, the mean PI was 43%. Statistical analysis reveals no significant differences in the PI of classes taught in STEM vs. non-STEM disciplines, or between upper vs. lower division courses. However, the PI in larger classes was found to be significantly greater than in small classes (64% vs. 39%, respectively; p=0.02). Moreover, classroom activities aligned with an active learning standard in Language and Literacy Development (e.g., students answering questions) occurred twice as often in small (24%) vs. large classes (12%, with p=0.02). Altogether, these findings indicate an opportunity for more active learning in large classes. We present a range of research-based pedagogical strategies that can be readily implemented in large classrooms, and encourage instructors to use their implementation as research opportunities to gather data on student success.

Keywords: Classroom Observations, Active Learning; Diversity; Hawai'i.

1. Introduction

Active learning (*i.e.*, "learning by doing" or "student-centered learning") has been shown to improve subject retention, increase student engagement, and reduce failure rates (*e.g.*, Springer *et al.*, 1999; Ruiz-Primo *et al.*, 2011; Freeman *et al.*, 2014), particularly for women (*e.g.*, Lorenzo *et al.*, 2006) and minorities (*e.g.*, Haak *et al.*, 2011). The Classroom Observation Protocol for Undergraduate STEM (COPUS) quantifies the degree to which a course uses active learning practices. For each two-minute interval of class time, a trained observer classifies what students and instructors are doing using 25 activity codes (Smith *et al.*, 2013). A recent nationwide (USA) COPUS analysis of 2000+ University classes found that the majority (55%) were taught using a "didactic" style ($\geq$80% lecturing); only 18% used a "student-centered style" ($\leq$50% lecturing). Large classes were especially likely to be didactic (Stains *et al.*, 2018). In light of the overwhelming benefits of active learning, these results are troubling, particularly for minority-serving institutions like the University of Hawaiʻi at Mānoa (UHM), one of the most diverse universities in the US (US News and World Report, 2019).

The Center for Research on Education, Diversity, and Excellence (CREDE) funded 31 research projects on teaching culturally and linguistically diverse students (Yamauchi *et al.*, 2016). The resulting CREDE standards are evidence-based best practices based on Vygotsky (1978) and 40+ years of research on interaction-rich dialogues to promote conceptual understanding (Tharp *et al.*, 2000). The US Department of Education ranked the CREDE standards the most effective for promoting reading achievement, and 2nd most effective for improving English language literacy among 73 studies of language development for English language learners (Yamauchi *et al.*, 2016).

This case study aims to: (A) assess the degree to which active learning is being used in UHM classrooms via COPUS; (B) identify any correlations between the level of active learning and certain class characteristics (class size, subject content, and academic level); and (C) evaluate the enactment of CREDE standards for teaching diverse students.

2. Methods

This study was conducted over six semesters (2015-18). After receiving UHM Institutional Research Board (IRB) approval to work with human subjects, COPUS observations were conducted by five observers, whose training included video and in-class practice. Inter-rater reliability exceeded 95% among all 5 observers using Jaccard (1901) similarity scores, indicating robustness. Each two-minute class interval was categorized as *Passive* (intervals during which students were only "listening" and/or "waiting") or *Active* (intervals including at least one student activity other than listening or waiting) (Smith *et al.*, 2013). We define the "passivity indicator" (PI) as the ratio of passive intervals to total intervals.

To determine whether student activity levels correlate with certain class characteristics, each class was categorized in three ways: A) STEM (0) vs. non-STEM (1), B) Upper (0) vs. Lower (1) Division, and C) Large (0), *i.e.*, >50 students, or Small (1), *i.e.*, <50 students. (Binary numeric "dummy" variables (0 and 1) were assigned to enable multivariate analysis). For each category, the mean and standard deviation of PI were calculated. Using box plots and analysis of variance (ANOVA) type III analysis, PI were compared first within each class category, and then across class categories to check for interactions, using significance level α= 0.05.

Lastly, COPUS codes were compared to three CREDE standards: Joint Productive Activity (JPA), Language & Literacy Development (LLD), and Instructional Conversation (IC). For each, COPUS codes were assigned corresponding to the class times during which the CREDE standards were or were not enacted (Table 1). Mean percentages of class times spent enacting each CREDE standard were then calculated for all classes.

Table 1. CREDE Standards Performance Continuum & corresponding COPUS Codes for evaluating the enactment of CREDE Standards in the classroom.

CREDE standard[1]	Enacted (COPUS Codes) [2,3]	Not Enacted (COPUS Codes) [2,3]
JPA	Students and instructor collaborating on joint product (student: OG; instructor: MG)	Students working on individual products (student: Ind; instructor: W)
LLD	Instruction in which academic language use by student predominates (student: AnQ, SQ; instructor: AnQ, PQ)	Instruction dominated by instructor talk (student: L; instructor: Lec)
IC	Goal-directed, fully inclusive conversation between instructor and small group of students (student: - ; instructor: 1o1)	Informal, non-academic discourse in whole-class settings (student: WC; instructor: -)

[1]JPA (Joint Productive Activity); LLD (Language & Literacy Development); IC (Instructional Conversation) (CREDE, 2019); [2]Student COPUS codes: OG (group activity); AnQ (answering questions); SQ (student asks question); Ind (individual thinking); L (listening); WC (whole-class discussion); [3]Instructor COPUS codes: MG (moving and guiding student work); AnQ (answering questions); PQ (posing questions); 1o1 (1-on-1 extended discussion with individual student); W (waiting); Lec (lecturing) (Smith et al., 2013).

3. Data and Results

3.1. Extent of Active Learning

Our dataset is comprised of COPUS observations of 64 classes, each taught by different instructors, in 35 academic departments at UHM. First, we calculated the PI to assess the degree to which active learning occurs in UHM classrooms. PI for the 64 classes ranged from 0-88%, with a mean of 43%, and standard deviation of 28%. These results compare favorably with the USA-wide results (mean=55%) reported by Stains *et al*., (2018), which indicate that UHM courses are on average less didactic.

3.2. Correlations between Active Learning and Class Characteristics

No statistically significant differences were found in the PI of classes taught in STEM vs. non-STEM disciplines, or between Upper vs. Lower division courses (Table 2). Our key positive finding concerns class size: The difference in mean PI between large classes (PI=64%) and small classes (PI=39%) was highly significant (p=0.02; Table 2) and consistent with nationwide results (Stains *et al*., 2018). In other words, instructors were statistically less likely to use active learning strategies in classes with >50 students.

Table 2. Results of Passivity Indicator (PI) analysis of 64 classes.

Class Characteristic[1]	PI Mean (stdev) [2]	n[3]	p-value[4]
STEM (0)	49.1 (27.2)	47	0.23
Non-STEM(1)	27.7 (24.2)	17	
Upper (0)	43.4 (24.9)	34	0.53
Lower (1)	43.4 (31.4)	30	
Large (0)	64.1 (25.0)	11	0.02*
Small (1)	39.1 (26.7)	53	

[1]STEM courses defined by NSF (2014); Upper and lower division courses defined as 300-400 and 100-200 levels respectively. Large classes have >50 students, small classes have <50 students (Freeman et al., 2014); [2]PI mean (and standard deviation) shown as %; [3]Number of classes; [4]P-value, * indicates statistical significance at α=0.05.

3.3. Enactment of CREDE Standards

As statistically measured by COPUS, the CREDE standards JPA and IC were only used during ≤6% of class periods so were not further analyzed for this study. However, the COPUS codes for activities corresponding to enacting the CREDE standard LLD were used by students and instructors nearly a quarter of the time during small classes, and significantly less (p=0.02) during large classes (Table 3).

In small classes, students spent 24% of their time answering questions (AnQ) and instructors spent 20% of their time posing questions to students (PQ). In large classes, these figures were 12% and 11%, respectively. Similarly, in small classes, students only spent 50% of their time passively listening (L), which is not a CREDE activity, whereas in large classes they spent 66% of their time passively listening. All three differences between large and small classes were statistically significant, with p-values of 0.02-0.04 (Table 3).

Table 3. CREDE results for Language & Literacy Development as determined by COPUS.

LLD COPUS Codes[1]	SmalliClass n = 53 meani(stdev)[2]	LargeiClass n = 11 meani(stdev)[2]	p-value[3]
(+) AnQ (s)	24.0 (15.1)	12.1 (11.3)	0.02*
(+) SQ (s)	7.3 (8.7)	3.6 (5.0)	0.18
(+) AnQ (i)	5.5 (6.9)	2.7 (3.9)	0.20
(+) PQ (i)	19.8 (11.6)	11.3 (8.7)	0.03*
(-) L (s)	50.4 (21.9)	66.2 (25.0)	0.04*
(-) Lec (i)	35.3 (20.9)	45.8 (21.1)	0.14

[1]COPUS codes (see Table 1 for details; Smith et al., 2013) that match the Language & Literacy Development CREDE standard (CREDE, 2019); (+) indicates LLD is being enacted; (-) indicates LLD is not being enacted; (s) is for students, (i) is for instructors; [2]Large classes have >50 students, small classes have <50 students (Freeman et al., 2014); n = number of classes; Mean % (and standard deviation) of class time spent doing the activity indicated by the COPUS code; [3]P-value as calculated using student t-tests, * indicates statistical significance at α=0.05.

4. Discussion and Recommendations

Despite compelling evidence that large classes can (*e.g.*, Deslauriers *et al.*, 2011) and should (Freeman *et al.*, 2014) be taught in an active way, active learning is not regularly occurring in large classes at UHM (this study) or elsewhere (Stains *et al.*, 2018). Our findings are alarming for two reasons: 1) Most students in our study were enrolled in large courses (n=1182 in 11 large classes, vs. n=1137 in 53 small classes); and 2) Active learning strategies have been shown to disproportionately benefit minority students (Haak *et al.*, 2011), and these students make up 34% of the UHM student body (US News and World Report, 2019). Although there is no specific recommendation for an optimal level of active learning, clearly a PI of 64% is too passive; large classes should strive for the PI reported for small classes.

Insight into the challenges that UHM faculty face in teaching large classes effectively comes from post-COPUS discussions with instructors of large courses, who revealed

sentiments of disbelief or anxiety about using active learning techniques: *"In large classes I struggle just to get through the material. Taking time to do group activities with 160 students means that I would get even farther behind."*

For instructors accustomed to traditional lecture techniques, the prospect of completely revamping a high-enrollment course might seem daunting. Fortunately, small changes in instructional approach can yield significant, positive changes in student activity levels and learning outcomes, especially for diverse students (Haak *et al*., 2011), with minimal effort from instructors (*e.g.*, Freeman *et al*., 2014; Bruno *et al*., 2017). Here is a sampling of easy-to-implement, active learning practices that have been shown to work effectively in large classes, with corresponding CREDE standards. References are provided for further review.

1. **Collaborative / 2 stage exams** (Gilley & Clarkston, 2014; Bruno *et al*., 2017). Within a single class period, students take an exam twice: first on their own, and then in groups of 3-4 students that must agree on all answers. Enacts CREDE standard for JPA.
2. **Think/Pair/Share** (Lyman, 1981; SERC, 2019). Students THINK individually for a few moments about a question posed by the instructor; then PAIR up with another student to discuss their responses; then selected student pairs SHARE their ideas with the class. Enacts CREDE standards JPA, LLD, and IC.
3. **Group Worksheets** (Manjula *et al*., 2010; CWSEI, 2013). Instructor creates a worksheet of questions to lead students through class content in a structured way. Make the first questions relatively easy, so that most groups know how to start, and make later parts more challenging. Enacts CREDE standard for JPA.
4. **Flipped Classrooms / Peer Instruction** (Crouch & Mazur, 2001; Smith *et al*., 2009). Before class, students review course materials. In class, instructor poses questions based on pre-class preparation. Students answer individually. Instructor reviews student responses with whole class. In groups, students revisit question and discuss with their peers. Repeat until consensus is reached. Enacts CREDE standards JPA, LLD, and IC.

Faculty at UHM indicate a strong desire to teach less and instead conduct more research (ACCFSC, 2018). This presents an opportunity for instructors to turn their classrooms into test laboratories for evidence-based teaching techniques, with IRB approval. Two sections of a course taught by the same instructor could include a control section taught in a traditional lecture-only format, and an experimental section that included active learning or CREDE strategies. Student success measures could be compared between the two sections, possibly resulting in peer-reviewed publications to support progress towards tenure.

5. Conclusions

At UHM, we evaluated the use of active learning strategies across class types using COPUS, and found UHM classes to be less didactic (43% didactic) than nationwide averages (55%). However, large classes (>50 students) at UHM are taught significantly less actively than are small classes. This is also true with respect to the enactment of the CREDE standard LLD, which consists of question and answer sessions between instructors and students. Since active teaching strategies have been shown to work just as well in large vs. small classes, we present a range of activities that are easy to implement in large classes with minimal effort. We encourage faculty to use these techniques to better serve their diverse students, and also to create test laboratories within their classrooms to evaluate efficacy and disseminate results.

Acknowledgements

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Working while studying – some legal and political questions affecting the right to higher education in Estonia

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Abstract

This paper explores some of the social dimensions affecting higher education policies in Estonia, and in respect to the European Union (EU) institutional framework and priorities, and looking at higher education as a fundamental human right. From this perspective, the aim is to establish that understanding underlying phenomena becomes key to respond strategically, raise awareness and improve the development of academic policies at the national and institutional levels. The combination of work and studies is one of the most critical dimensions to factor into this assessment but it has been neglected in the practice. Lecturers and other faculty members intervene, developing independent academic policies and initiatives in the absence of a pre-concerted strategy, expertise, mandate and/or capabilities. Instead, universities should prepare for unorthodox engagements adapting to the students in need, and train their faculties to facilitate a shift towards less traditional learning environments. Responsive adjustments to the current social developments can be interpreted to be the proper way or the state to perform its duties and to better guarantee the exercise of the human right to education.

Keywords: working while studying; right to education; education policy;responsive policy; Estonian higher education policy.

1. Introduction

The social dimensions of the higher education policies in the European Union (EU) have become priority concerns for all member states.1 Better student life conditions are expected to have a positive impact on the region´s research and innovation capacities and promote growth. The combination of work and studies gains relevance as one of the most critical dimensions, with serious implications on academic and labour market performance. Devlin et al (2008) said: "The working student is likely to be a reality for universities regardless of the level and availability of income support. /…/ The traditional idea of linear school, university, work progression, which still informs much policy and practice in high education, no longer holds true."

Broad changes in the structures of labour relations push the expansion of working while studying as well as the need to become competitive in the labour market obtaining field experience and training non-academic skills. The flexibilization of employment rules and policies in general, has allowed differentiated types of contracts and opportunities that did not exist in the past, such as work on demand, part-time and working from home. It would be useful if a matching flexibilization of academic rules and policies could follow.

Estonian policy makers should share these concerns as the percentage of students who work in the country increases steadily, raising to 32% in 2016, when 53% of the students who work did so during study periods (PRAXIS 2017, p. 53, 98). According to the EUROSTUDENT (2016-2018), this is common also in other member states where work is necessary to cover for the costs of higher education. The figures vary nonetheless; it is reported that in Central and Eastern Europe, students work more than 30 hours per week and in Western Europe up to 28, while in Denmark, Netherlands, Germany and Switzerland, they spend less than 20 hours working. In Estonia, students work because of financial reasons, mainly; 66% cannot afford studying alone (PRAXIS 2017, p. 5-6). Similarly to the students from other EU countries, they cannot exclusively rely on parental and state support (see e.g. Kalenkoski et al 2008). Furthermore, working while studying has extended to the secondary school level where the students have the need to engage in paid jobs because some of them already have dependants or/and work to save for future study related expenditures.

While the right to education is indisputably a fundamental human right consigned in the Estonian Constitution, it was seen to include the right to higher or tertiary education when the European courts recognized it (Gilchrist, 2018). The extent to which the state is responsible for people's formal learning processes should also be clarified, given the incentives and promotion of lifelong learning in Europe (McCowan, 2012). For states to determine how to support students more responsively, a wider range of research and

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[1] About the EU policy on education see: https://ec.europa.eu/education/policies/higher-education/inclusive-and-connected-higher-education_en

discussions are warranted. This paper briefly introduces some of the dimensions that should be factored in the planning and formulation of responsive policies and legislative developments affecting higher education in Estonia, taking into consideration the need to generate institutional adaptability capacities in the sense indicated by Tomasevski (2006), and facilitate inclusiveness.

2. High education as a human right and constitutional right

Tomasevsky (2006) worked and reported governmental human rights obligations in education, structured into a so called '4-A scheme' -education must be available, accessible, acceptable and adaptable. She explained that the concept of adaptability was developed by courts when addressing the right to education of children with disabilities, but this paper argues that it is an institutional capacity applicable at all other levels by extensive interpretation. Governmental obligations in connection to human rights include proactive action and reaction in pursuit of goals and to achieve particular results, thus adapting becomes a core feature of the state's educational strategies as it would mean to put in place corrective actions when required. Tomasevsky's scheme endorses the inclusiveness defined as *"concerned with identifying and overcoming all barriers for effective, continuous and quality participation of all in education"* (Ramchand & Dummugudem, 2014).

An inclusive right to education is established in art. 37 of the Estonian Constitution. Therefore, and recognizing the importance of the ongoing debate on whether higher education constitutes an objective responsibility of states or a privilege (McCowan, 2012), a broad interpretation of inclusiveness is assumed and core to the discussion proposed in this paper. Art. 26 of the Universal Declaration of Human Rights of 1948 (https://www.ohchr.org/EN/UDHR/Pages/UDHRIndex.aspx), established that *"high education shall be equally accessible to all on the basis of merit"*. The same principle is reflected in other international conventions, e.g. the United Nations International Covenant on Economic, Social and Cultural Rights (https://www.ohchr.org/en/professionalinterest/pages/cescr.aspx), the International Convention on the Elimination of all Forms of Discrimination against Women http://www.un.org/womenwatch/daw/cedaw/cedaw24/cedawcegy45.pdf), and the UNESCO Convention Against Discrimination in Education (http://portal.unesco.org/en/ev.php-URL_ID=12949&URL_DO=DO_TOPIC&URL_SECTION=201.html) (Gilchrist, 2018. pp. 645; 676). Furthermore, The Council of Europe declared that fair and equal opportunities of access to tertiary education should be available to all the capable and willing (Council of Europe 1998:2.1).

If the right to education should exclusively depend on will and merit, the students´ financial status cannot impede study access without raising serious concerns. Most discussions focus

on admission processes, but refrain to address subsequent challenges such as financial strain during the time of studies or the inability of the students to balance incompatible schedules and responsibilities deriving from the academic policies of universities and other higher education institutions. Even though it is not possible to guarantee certain outcomes in the exercise of the right to education, working while studying is an expanding phenomenon that affects the achievement of individual, collective, institutional, state and regional goals significantly (Communication, 2017). It can be said that when higher education institutions ignore the larger scope of student´s constraints, they are violating constitutional rights and undermining the development of their "*full dignity and potential*" (Gilchrist, 2018, p. 647).

The Estonian EUROSTUDENT VI survey, revealed that while students graduate from high school at age 19-20, the average student at the tertiary level is 25-26 years of age, and a large proportion of them are 30 and older. 87% of these belong to the segment that are employed amounting two out of three students (PRAXIS, 2017). What is more, the education policy in place benefits people enrolling in the university right after secondary school, despite the demographic evidence showing that most of the student population are not recent highschool graduates and are much older. In the light of the data, the state should adjust the existing policies to meet the actual needs of the student population and to help it institutions to adapt. This should involve facilitating for people the balance between work and studies.

The country's higher education reform of 2013 sought to eliminate obstacles to access tertiary education. However, it does not refer to full-time day-studies students who also work. Similarly, the reform refers to scholarships, financial support and study loans, but fails to create or promote the conditions for students who need to work (see Kõrgharidusprogramm 2017-2020). In the absence of guidelines or explicit indications to interpret the state education policy as in support of the combination of work and studies, it is not possible for academic directors and manager level officials in universities, to justify and develop effective ones on their own; some strategies and decisions could contradict state policies and/or step over the boundaries of the institutional mandates. It is observable that university staff and faculty members consider that the primary and perhaps only occupation of students should be their study plan. Full dedication to the university activities is encouraged, expected and in times required to pass some courses. However, this view does not consider the limitations of the students or responds to the constraints of the institutions, such as the shrinking of the student population and the reduction of budgets that have forced the closure of distant learning programmes and other differentiated instruction schemes. Nowadays, full-time day-study groups are mixed with part-time groups, paying students with non-paying students, and people of all ages, backgrounds and expertise. It would be reasonable for universities, to ensure an acceptable student enrolment, to consider the proportion of students who have to work, and useful to adapt to the socioeconomic reality. This could be done by re-organising traditional academic strategies and adding flexibility rather than to forcing people to choose

between exercising the fundamental right to education and/or making studying and working orthogonal to one another in practice (PRAXIS, 2017, p. 5-6).

3. State support versus working

To maintain a full-time status, a student must complete 30 ECT per semester, that is, 16 weeks, and means a learning average of 48 hours per week. Similarly, 48 hours is the maximum an employee can work weekly (the standard is 40 hours according to Estonian labour law), and this may be the situation for many students considering the demographic segmentation revealed in the aforementioned study. In average, a student who is older than 30 years, spends ca 70 hours per week combining work and studies: 16 hours for lectures, 16 hours for independent studies, and 38 hours for work. In addition, at least 72% of those already have children, which increases their responsibilities, and intensifies their workload significantly (PRAXIS, 2017).

At first glance, the support allowances for full-time day-studies in Estonia appear to be generous: First, most programmes in state universities are tuition-free; Second, study loans, basic allowances and need-based allowances are widely available, employees have the right to get study licences yearly, the libraries are excellent, and provide access to the main academic databases and all the resources required at no fee, and dormitories are affordable. However, at a closer look, these benefits hardly alleviate any of the personal or financial limitations experienced by the students, which according to the literature, is also the case in a number of other countries (Hortósy *et al.,* 2018; Devlin *et al.,* 2008; Evan *et al.,* 2014).

Currently, to obtain a study loan of 2000 €per study year (166 €month), that must be repaid right after graduation, an applicant should have at least two guarantors or be able to constitute a mortgage. The basic allowance that is supposed to cover study-related expenses comes from the university budget and is granted for only 10 months per year, depending on the students´ performance. It is usually set at 100 €(higher profession-based scholarships in are allocated to specific curriculums). The allowance assigned on the basis of financial need ranges between 75-220 €per month, paid 10 months a year, and calculated according to the family income. Family include the parents of students up to 24 years of age, if not married, or when the parent or guardian of a child. Minor siblings and half-siblings are also family members. Up to 52% of the applying students get this allowance, but only 1/3 of these get 220 €, 21% get 135 €and 44% get the minimum amount of 75 €(Valk, 2018, p. 18).

Linking the students´ financial capacity to the family income until they are 24 years of age is a controversial provision, and feedbacked by the students as an unfair system (Valk, 2018, p. 5), because according to Estonian Family Law Act, the parents are obliged to maintain a child only until the age of 21. On the one hand, parents do not have to support a child after turning 22, but on the other hand, when applying to the need-based allowance, the income of the

parents accrues the applicant's, diminishing the allowance that she/he may be otherwise entitled to. It could also be asked whether the law respects human rights consigned in the constitution and other international regulations, or follows the general principles of law. The majority of students in Estonia finish their bachelor studies at age 23, when they have *technically* lost the right for parental support. Even if some of the parents continue to help their children financially after that age, it cannot be assumed, thus this regulatory oversight should be addressed.

To summarize, the amount of money that a student can receive from the state, would consist of: a study loan – 166 €per month; a study allowance – 100 €for 10 months, depending on grades, and very sparingly granted; and an allowance based on need – 75-220 €, mostly set at the lowest (Valk, 2018, p. 5), for a total of 341€ that is less than a minimum legal salary (currently set at 540 €). The average monthly study and living expenses, excluding accommodation, such as food, transport, clothes, medicines, equipment and supplies etc. by far exceeds this sum.

The insufficient availability of funds and lack of financial resources from the state have changed the students´ attitude towards allowances (PRAXIS, 2017). They must cover for many of their basic needs on their own. Working while studying is the trend even among the students that receive support. More income does not only represent better living standards, but these students consider that working experience is an additional value and makes them more competitive as employees in the labour market. They learn time-management, communication and problem solving skills at work (Darolia, 2014, p. 47). Pemberton *et al. (*2013, p. 269), notes that those *"'Employability skills' have become more important than just the degree"*. The Estonian 2015 survey (Valk, 2018 p. 5) shows that for 8 in 10 students, getting an allowance had no impact in their decision to work at the time of studies. Other reasons should be researched more systematically to explain the in detail the student's motivations. For example, Hovdhaugen (2015, p. 633) found that in Norway student loans are more than enough to fully support students, but they still prefer to go to work. The data available in Estonia is inconclusive.

4. Conclusion

This paper showed that the combination of work and studies is one of the most critical and yet overlooked dimensions in education policies, with unaccounted implications on academic and labour market performance. Comments such as: *"I was working the whole day and night, even though I had learned for the exam I was too tired, and could not concentrate or think clearly"*, and *"I am too busy at work and could not study for the test"* are becoming too common at all levels in Estonian universities. Absences are also on the increase, with students trying to comply with too many responsibilities at the time, and becoming unable to attend

classes and participate in examinations, not to mention other academic activities. This should seriously impact the quality of teaching and the courses' management of lecturers, but remains largely under researched, as well as is the effect that studying may have on their work. At present, the faculty members are on their own to decide how to adjust their courses, and on a case by case basis, without institutional backup or clear guidance to legitimate these processes. At the administrative levels of the universities and related state entities the awareness of the need for updates and unity is lower. It seems necessary to introduce correctives, formulate new and effectively inclusive ´flexible learning schemes' or proposals that could adapt to reality responsively, and train employees to work with these students or search for faculty members with the necessary competences. Stronger institutional capacities to adapt to social changes must be developed, as the reports by Tomasevsky compellingly stated more than a decade ago (2006). This paper urges reflection and coincides with Calderwood *et al.*(2017, p. 2) when speaking of the results of the Eurostudent study of 2015, on that understanding the spill over effects of the study and work processes affecting resources' demand and allocation is crucial to increase the well-being of students who work, and in turn their contributions to society.

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Development of a procrastination scale in Spanish and measurement of students' procrastination tendencies

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Abstract

Academic procrastination (students' tendency to postpone and/or avoid an academic task) is a widely extended phenomenon in education, especially among university students. However, there is still little research on this topic and no single validated and widely accepted instrument to measure procrastination levels at university level in Spain has been developed yet. This study aimed to cover this gap and develop a procrastionation scale adapted from two existing instruments and to measure the procrastination tendencies of a sample of 529 students from two different universities. The results showed that the Escala de Procrastinación Académica en español (EPAE) has excellent reliability ($\alpha = .929$). In addition, over 17% of the sample reported high procrastination levels. Although further research is needed, this preliminary study sheds light on this topic and contributes to the development of a measurement instrument that may be used to monitor student learning and identify, among other issues, students at risk of dropout.

Keywords: academic procrastination; university student; validation; higher education

1. Introduction

Early studies on procrastination as a phenomenon with negative connotations date back to the 1980s, and describe it as "the act of needlessly delaying tasks to the point of experiencing subjective discomfort" (Solomon & Rothblum, 1984, p. 503), while others refer to it as the "lack or absence of self-regulated performance […], a tendency to [deliberately] put off or completely avoid an activity under one's control" (Tuckman, 1991, p. 474). More recent study claim that "procrastination is not an irrational personality disorder; it is a logical, albeit potentially inefficient, behaviour driven by a reasoned comparison of perceived costs and benefits" (Zarick & Stonebraker, 2009, p. 211). Individuals may procrastinate in all sorts of everyday activities, as well as in academic and professional context, for various reasons and not always with negative connotations, so this phenomenon is multifaceted.

Although procrastination has been subject of analysis for the past thirty years, research is still needed to fully understand this complex and multifactorial phenomenon, which is often confused with laziness or self-indulgence (Natividad Sánchez, 2014). Literature reviews on procrastination, although not all systematic in nature, reveal that the prevalence of procrastination is particularly high among university students (see Steel, 2007) and that a better understanding of this phenomenon may contribute, among other things, to reducing dropout rates (Garzón Umerenkova & Gil Flores, 2007).

Steel's (2007) meta-analysis of procrastination's possible causes and effects showed that neuroticism, rebelliousness, and sensation seeking show only a weak connection to procrastination, while strong and consistent predictors of procrastination were task aversiveness, task delay, self-efficacy, impulsiveness, conscientiousness and its facets of self-control, distractibility, organization, and achievement motivation. Other studies have found that high levels of procrastination are related to poor academic performance (Steel, 2007; Tuckman, 1998; Zarick & Stonebraker, 2009), fear of failure (Solomon & Rothblum, 1984), increased levels of psychological distress, and a tendency to seek high but unrealistic aims (perfectionism) (Flett, Stainton, Hewitt, Sherry, & Lay, 2012).

For the past decades instruments have been designed to measure procrastination in general terms and when undertaking academic tasks. Some of most widely used in the latter group are: Solomon and Rothblum's (1984) Procrastination Assessment Scale for Students (PASS), Busko's (1998) Procrastination Scale, and Tuckman's (1991) Procrastination Scale (TPS). In Spanish language some of the aforementioned scales have been adapted, such as Furlan, Heredia, Piemontesi, and Tuckman's (2012) adaptation of Tuckman's TPS to Argentinian students (ATPS), and Álvarez Blas' (2010) adaptation of Busko's Academic Procrastination Scale. There is, however, a lack of consensus as to what is the most appropriate instrument.

In light of the association between procrastination and other variables, monitoring procrastination may become the focus of attention of academic authorities interested in assessing and understanding student learning and learning outcomes (process and results). Proper detection with reliable instruments ensures that procrastination is diagnosed, or even predicted, and its negative side effects are minimized with the help of intervention programmes. Thus, the aims of this study were: a) to develop and validate a scale to measure academic procrastination in Spanish by adapting two existing instruments and, b) to measure the procrastination tendencies of a sample of university students.

2. Method

2.1. Participants

Data were collected from 574 students (present in class at regular teaching hours) from year 1 and 3 from two Spanish universities, while 529 questionnaires turned out to be usable. Students were selected by non-probability sampling. Participation was voluntarily once students had been informed about the study objective and their rights in terms of confidentiality and anonymity of data. Tables 1 and 2 show descriptive data sorted by university, degree and gender.

Table 1. Distribution of the sample (*n*=529) by university and degree (academic year 2017-2018).

University of Murcia (UM)						University of Castilla-La Mancha (UCLM)					
(n=354), FEM: 80.2%; MAL: 19.8%						(n=175), FEM: 60%; MAL: 30.9%					
TEL		PE		SE		TEL		PE		SE	
n	%	n	%	n	%	n	%	n	%	n	%
0	0	183	51.7	171	48.3	30	17.1	88	50.3	57	32.6

Note. TEL: Telecommunications Engineering, PE: Primary Education, SE: Social Education; FEM: females, MAL: males

2.2. Design and procedure

This study implemented a survey design as researchers were interested in participants' opinions and perceptions about the extent to which they procrastinate in academic tasks. Administration time was approximately 22 minutes, took place in regular classrooms, and followed the same administration procedure previously agreed by the researchers.

2.3. Data collection

An ad hoc scale was designed adapting two existing instruments as a basis, namely Tuckman's (1991) 35-item Procrastination Scale and Busko's (1998) 28-item "Student Procrastination Scale" in order to measures Spanish university students' levels of academic procrastination. The reason for choosing these two scales was that they have both been widely used in previous studies. The resulting scale (Escala de Procrastinación Académica en español (EPAE) / Academic Procrastination Scale in Spanish) had 33 items and was made up of the 16 items specifically focused on academic procrastination in Busko's scale, 16 selected from the Tuckman's scale, and an additional item derived from splitting one of Tuckman's items into two for the purpose of clarity. This additional item was, however, later removed because of a low loading (below .3).

Following prior studies the final version of the questionnaire was made up of two dimensions: a) 17 procrastination items (12 from Tuckman and 5 from Busko), and b) 15 non-procrastination items (4 from Tuckman and 11 from Busko). The final selection of items was done in terms of relevance to the aim of this study, namely procrastination in academic tasks. Examples of items were "*When I have a deadline, I wait till the last minute*" (procrastination dimension) and "*I generally prepare well in advance for exams*" (non-procrastination dimension). When completing the scale participants had to chose between four options in terms of whether each scale item described them when facing acadmic tasks (1-This is not me at all, 2-This is usually not me, 3-This is usually me, 4-This is definitely me). As the participants were Spanish speakers and the scales were originally written in English, the researchers implemented the back-translation method as one of the recommended techniques (Epstein, Miyuki Santo, & Guillemin, 2015).

2.4. Data analysis

In order to validate the academic procrastination scale designed in this study, an exploratory factor analysis (EFA) using Maximum Likelihood (ML) analysis with oblique rotation was performed using statistical programme SPSS version 24. In addition, Cronbach´s alpha was used to calculate the internal consistency of the scale.

3. Results and discussion

3.1. Structural validity

Two EFA using Maximum Likelihood (ML) with oblique rotation were performed using the 33 items initially proposed by the researchers. The first EFA resulted in 7 factors but the second was forced to two factors in order to accommodate the two profiles (procrastination and non-procrastinator). Preliminary results showed that all items in the procrastinator dimension loaded as expected and had coefficients above .3. There non-procrastinator

dimension showed some irregularities, namely item 1 ("*I rarely put off until tomorrow what I can do today*", Busko's item 15), item 6 ("*Whenever I make a plan of action, I follow it*", Tuckman's item 25), and item 19 ("*Putting something off until tomorrow is not the way I do it*", Tuckman's item 34) did not reach a coefficient of .3 in this dimension and had a negative loading above .3 in the procrastinator dimension. In addition, item 11 ("*I always finish important jobs with time to spare*", which is item 29 in Tuckman's scale) had a very load loading, so it was discarded and a new EFA with 31 items was performed (Table 2).

3.2. Internal consistency

Cronbach´s alpha coefficients were calculated for each of the two scales (procrastination profiles) resulting from the forced EFA once the incongruent item (11) had been discarded. The results showed excellent reliability coefficient in the procrastinator dimension (α = .913) and good reliability coefficient in the non-procrastinator dimension (α = .841) following George and Mallery's (2003) rule of thumb for the acceptability of reliability coefficients (namely, >.9, excellent; >.8, good, >.7, acceptable; >.6, questionable; >.5, poor; and <.5, unacceptable). Similar to Tuckman (1998), reliability of the whole scale was calculated bearing the scale as unidimensional, which involved turning negative scale statements into positive. In this case, reliability was . 929, which is excellent.

3.3. Procrastination tendencies of Education students

Similar to Tuckman (1998), and taking the scale as unidimensional as described earlier, mean scores were calculated, so students were divided into three groups: a) those with mean score 1-2 (low tendency to procrastinate), b) those with mean score 2-3 (medium tendency to procrastinate), and c) those with mean score 3-4 (high tendency to procrastinate). As shown in Table 3, about 45% of students showed medium procrastination tendencies when accomplishing academic tasks, while over 17% turned out to be high procrastinators.

Table 2. Factor structure of EPAE forced to two factors and without item 11.

	Procrastinator	**Non-procastinator**
Item 9	,813	
Item 5	,794	
Item 4	,781	
Item 12	,748	
Item 14	,710	
Item 15	,709	
Item 13	,674	
Item 10	,673	
Item 21	,603	
Item 31	,573	
Item 24	,571	
Item 8	,515	
Item 23	,485	
Item 3	,443	
Item 18	,428	
Item 22	,421	
Item 19	-,379	
Item 1	-,366	
Item 7	,349	
Item 6	-,336	
Item 28		,687
Item 30		,667
Item 29		,639
Item 26		,552
Item 20		,516
Item 25		,506
Item 17	-,319	,430
Item 16		,428
Item 27		,405
Item 32		,327
Item 2		,312

Extraction Method: Maximum Likelihood. Rotation Method: Oblimin with Kaiser Normalization. Items in gray are procrastination items. Items in italics are adapted from Busko (1998) and the remaining from Tuckman (1991). Loadings below .3 were discarded.

Table 3. Distribution of the sample (*n*=529) by tendency to procrastinate

Low		Medium		High	
n	%	n	%	n	%
199	37.6	307	45.1	23	17.3

4. Conclusions

This preliminary study developed a procrastination scale in Spanish language after adapting two existing and widely instruments in English. Factor analyses helped identify a dissonant item which was discarded, so the final version had 31 items. The new scale, Escala de Procrastinación Académica en español (EPAE) (Academic Procrastination Scale in Spanish) has an excellent reliability coefficient as shown in this study, and can safely be used to measure Spanish higher education students' procrastination tendencies.

This study also showed that over 17% of the sample may be described as high procrastinators, which could negatively influence their learning. Further analysis would be required on these students by collecting qualitative data in order to fully understand this phenomenon. In addition, further studies may wish to access students' academic record in order to compare grades and procrastination tendencies and identify any links that may support the literature. Moreover, a comparative analysis of procrastination tendencies of students in different academic years (i.e. freshmen and nearly graduates) may be worth doing.

Given the excellent inicial psychometric properties of the EPAE, it may be useful for monitoring students' learning, as high levels of procrastination are related to poor academic performance, as shown by previous studies (e.g., Steel, 2007; Tuckman, 1998; Zarick & Stonebraker, 2009). Thus, academic authorities may decide to administer it to identify those students at risk and develop intervention programmes accordingly. This would, in turn, reduce university dropout rates and foster retention. Furthermore, the EPAE may be useful to Counseling and Psychological Services at universities in order to identify possible cases of anxiety at early stage. Finally, reducing procrastination levels among university students may decrease stress levels among students, as well as improve the quality of the teaching-learning process.

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Self-efficacy in first-year university students: a descriptive study

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Abstract

The study and analysis of the self-efficacy beliefs of students has become an important line of educational research. The purpose of this study, conducted at Mondragon University (Spain), is to explore the different perceptions concerning the creative and entrepreneurial self-efficacy of students on their entrance to university. Results revealed clear patterns with regards to discipline and gender. Students commencing their degrees in social sciences show lower creative and entrepreneurial self-efficacy perceptions than their peers in other disciplines. Women show lower scores than men across different disciplines with the exception of women commencing engineering studies.

Self-efficacy has been related to student motivation and learning and has been found influential in the choice of the professional career. The high significance of this construct in education makes the results of this study have clear implications for the development of learning environments that address the differences found between gender and disciplines. Directions for future research are also indicated.

Keywords: Self-efficacy; university students; gender; creativity; entrepreneurship.

1. Introduction

Self-efficacy, the confidence people have in their ability to do certain tasks (Jordan & Carden, 2017), has become an important line of investigation in educational research. Several studies have revealed the key role self-efficacy plays in student performance and learning by means of affecting the tasks chosen by them, their effort, perseverance and performance (Schunk, 2003). The role of the self-efficacy construct as mediator and predictor of student performance, motivation and learning has been also identified in higher education (Van Dinther, Dochy, & Segers, 2011). This study will analyse the self-efficacy perceptions, with regards to creativity and entrepreneurship, of a cohort of students as they commence their university experience. The development of creative and entrepreneurial skills, an explicit learning outcome of the institution in which this study has been developed, has become a significant subject of study in higher education (Daly, Mosyjowski, & Seifert, 2016; Newman, Obschonka, Schwarz, Cohen, & Nielsen, 2018).

Self-efficacy consists of an individual's confidence in his or her ability to effectively engage in behaviours towards desired goals (Bandura, 1997). There is increasing attention given to this construct in educational research (Van Dinther et al., 2011) and studies have confirmed the relationship between student self-efficacy and academic achievement (Bowman, Miller, Woosley, Maxwell, & Kolze, 2019).

Entrepreneurial self-efficacy (ESE) refers to an individual's confidence in his or her competence to perform entrepreneurial tasks and roles (Chen, Greene, & Crick, 1998). The relation between entrepreneurial self-efficacy and the entrepreneurial career has been analysed and clear patterns emerge: those with greater self-efficacy in this field show greater entrepreneurial intentions and greater confidence in the development of viable entrepreneurial ideas (Krueger, Reilly, & Carsrud, 2000; Segal, Borgia, & Schoenfeld, 2002). Other research shows the relationship between high entrepreneurial self-efficacy and behaviours related to entrepreneurship (Dempsey & Jennings, 2014; Hmieleski & Corbett, 2007).

Creative self-efficacy (CSE) has been defined as the confidence in one's ability to produce creative results (Tierney & Farmer, 2002). This relatively recent field, has revealed significant associations between creative self-efficacy and creativity outcomes in education and in other contexts (Beghetto, 2006; Farmer & Tierney, 2017; Jaussi, Randel, & Dionne, 2007; Shin & Zhou, 2007).

Self-efficacy research has consistently shown the predictive nature of students' self-efficacy beliefs in career entry behaviours, such as university degree choices and academic performance (Lent & Hackett, 1987; Markman, Balkin, & Baron, 2002).

The relationship between gender and self-efficacy has long been a focus of research. Wilson, Kickul and Marlino (2007) have found gender differences in entrepreneurial self-efficacy at the student level, with women having less confidence, on average, about their entrepreneurial capacity in relation to men. In addition, as suggested by Bandura, Barbaranelli, Caprara and Pastorelli (2001) women may be more strongly influenced than men by perceptions of lower skill in entrepreneurship.

Regarding creative self-efficacy and gender, the studies have showed weak differences, with men showing higher CSE scores and overestimating their creativity and women underestimating it (Beghetto, 2006; Karwowski, 2011; Karwowski, Lebuda, Wisniewska, & Gralewski, 2013).

To our knowledge, and despite the vast literature on entrepreneurial and creative self-efficacy, there have been no studies analysing the different creative and entrepreneurial self-perceptions of students on entrance to different university disciplines, the focus of this study.

2. Methods

The study involved all full-time students newly enrolled in the first year of Mondragon University, a private university located in the Basque Country (Spain). The four different Faculties of Mondragon University took part in the study; 89 students of the Faculty of Gastronomic Sciences, 177 students of the Faculty of Business Studies, 225 students of the Faculty of Humanities and Social Sciences and 301 students of the Faculty of Engineering participated in this study. Forty-four percent of the respondents were female (M_{age} = 18.22, SD = 1.58), fifty-five percent male (M_{age} = 18.55, SD = 2.45). The 710 students (M_{age} = 18.40, SD = 2.11) completed the entire questionnaire during class time.

The researchers were in charge of explaining the nature of the research, the access to the questionnaire and the procedures, as well as the privacy of the data.

Following the process of translation-back translation commonly used in research, the scales related to self-efficacy were translated independently from English into Basque and Spanish, to be later translated into English by two bilingual people and reviewed by the research team (Brislin, 1980).

Instruments. Creative self perceptions was assessed with Tierney and Farmer's creative self-efficacy measure (Tierney & Farmer, 2002). A sample item from this scale is: "I have confidence in my ability to solve problems creatively."

We used the four-item scale of Zhao et al. (Zhao, Hills, & Seibert, 2005) for assessing entrepreneurial self-efficacy. This scale measures the confidence of a person with respect to

the identification of business opportunities, creation of new products, creative thinking, and commercialization of ideas (Bullough, Renko, & Myatt, 2014).

3. Results

Table 1 displays means and standards deviations resulting from the sum of the corresponding items among the variables of interest. For the general sample, it was found that women had significantly both lower entrepreneurial and creative self-efficacy scores than men.

Table 1. Descriptive statistics

	Gender	Faculty	Mean	SD	N
CSE	Women	Business Studies	15,72	2,06	85
		Humanities and Educational Sciences	14,99	1,72	122
		Gastronomy	15,57	1,72	30
		Engineering	15,70	1,80	82
		Total	15,42	1,86	319
	Men	Business Studies	16,12	2,16	66
		Humanities and Educational Sciences	15,30	1,81	86
		Gastronomy	15,77	2,81	52
		Engineering	15,75	1,77	187
		Total	15,72	2,02	391
ESE	Women	Business Studies	14,99	2,25	85
		Humanities and Educational Sciences	13,21	2,95	122
		Gastronomy	14,80	2,26	30
		Engineering	15,22	2,01	82
		Total	14,35	2,64	319
	Men	Business Studies	15,29	2,17	66
		Humanities and Educational Sciences	13,83	2,35	86
		Gastronomy	15,71	2,20	52
		Engineering	14,87	2,02	187
		Total	14,82	2,22	391

However, as Table 1 shows, these differences depend on the discipline of study. Students initiating their studies in the Faculty of Engineering show a distinct self-efficacy pattern. Women in the Faculty of Engineering have similar CSE scores to men and higher ESE scores than men. An interesting parallel finding from this study is that students initiating their degrees in different disciplines present different self-efficacy patterns. As seen in Table 1, students commencing studies in the Faculty of Humanities and Educational Sciences show lower ESE and CSE scores than their university peers.

4. Discussion

The present study reveals differences regarding self-efficacy perceptions of men and women. Some researchers argue that these differences may have their origin in the stereotypical beliefs about gender that students have (Eisenberg, Martin, & Fabes, 1996; Harter, Waters, & Whitesell, 1997). These divergences are highly relevant because of their predictive role in future professional choices (Bandura et al., 2001). The corroboration of the gender differences that exist in this educational stage is an opportunity to address problems that can contribute to continuing the persistent gender disparity in the professional career.

Interestingly, women commencing their studies in the Faculty of Engineering show a distinct entry profile, these women commencing degrees in which they traditionally represent a minority (30% in our study) show a differentiated profile to their peers from other disciplines, Given the consideration of self-efficacy expectations as a mediator in career decisions (Ancis & Phillips, 1996; Bandura et al., 2001), this finding seems to document the relation between perceived occupational efficacy and career choice found in the literature (Betz & Hackett, 1983).

Another finding from the study is the lower self-efficacy perceptions, both creative and entrepreneurial, found in those students commencing their studies in social sciences disciplines. If, as the literature shows, perceptions of self-efficacy are decisive in the choice of the professional career (Lent & Hackett, 1987) a possible explanation for this lower self-efficacy could be that neither creativity nor entrepreneurship are perceived by this cohort of students as essential skills in humanities and educational science degrees.

However, both creative and entrepreneurial skills are distinctive features of a mindset that can prepare students to develop in a future characterised by change. The development of entrepreneurial self-efficacy is a valid objective in itself in higher education institutions, due to its recognised predictive role in the development of not only entrepreneurial intentions but also entrepreneurial behaviours (Krueger & Deborah Brazeal, 1994; Zhao, Hills, & Seibert, 2005). Regarding creativity, higher levels of creative self-efficacy have been related, not only to greater creative performance, but also to greater confidence in

academic skills and greater educational projection (Beghetto, 2006; Robbins & Kegley, 2010; Tierney & Farmer, 2004).

With regards to the research limitations, the study was limited to Mondragon University and therefore generalisability of the findings might be limited to this context. Additional quantitative and qualitative research is necessary to explore the external validity of the presented findings with regard to other countries, universities, and disciplines.

Furthermore, in the literature, concerns are raised about the use of one's perceptions, as they are potentially prone to biases and inaccuracies, and can cause problems when used as indicators of skills (Dunning, Heath, & Suls, 2004). However, this may not apply when what is required is a subjective assessment of the skill. In constrast it is worth noting that making an assessment of subjective capacity may be a step towards developing creative potential (Beghetto, 2007).

Undergraduate years are seen as a critical opportunity for students, representing the moment in which their confidence in their own skills is built and choices are made about future professional career (Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012). The significance of this educational stage and the malleable nature of the self-efficacy construct may support the design of educational interventions based on the self-efficacy development sources contemplated within social cognitive theory. In the view of the present study, these interventions should be directed at reducing the existing gender gap and changing pre-existing mental frameworks regarding the characteristics of professional profiles in different disciplines.

Future research could analyse the development of the self-efficacy perceptions of this cohort of students as they continue their university experience. The study of the environmental factors contributing to higher creative and entrepreneurial self-efficacy scores across genders and disciplines would provide valuable information, of particular interest to those researchers working in higher educational settings.

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Admission tools and academic performance: evidence from a first course in a bachelor's degree in business administration

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Abstract

Admission tools have become imperative means for private schools to handle both limited space and the search of excellence. We use a supervised algorithm to predict the score of admitted students in a private-run Spanish business school. The main target is understanding the effects of the features defined in the admission process to assess both the validity of the process and the final ranking of the student after one year in the school, trying to ascertain what is the best mix of the variables in place to forecast the final score of the students when ending their first year in the BBA; along with the mix, we also want to define the decision rules allowing the best prediction. The results will prove that the present admission process in place is working properly even if some fine tuning could be set in place for an even better performance.

Keywords: admission tools, competition, private education, business schools, regression trees

1. Introduction

Admission tools have become imperative means for private schools to handle both limited space and the search of excellence. The competition for the best students in Spain is getting heavier with the presence of different factors: public universities getting better every year, with some of them topping the rankings; a lowering in the waves of students accessing the university due to the demographic crisis; and a hike in prices that makes even more difficult to reach the best students. In the area of business administration, the situation is paradigmatic, but not exclusive. In health care area, the meta-analysis conducted by Campbell and Dickson (1996) showed grade point averages in nursing and related courses as the greatest cognitive predictors of student success; other elements as parental education and age were found as the greatest demographic predictors. The debate on the admissions tests as the SAT one (the used-to-be standard among American universities) is brought by Bollinger (2005).In the area of medical schools, that face large number of applicants with limited student places, Urlings-Strop et al (2013) tried to "determine the relative contribution of the non-academic and academic steps to differences found in student performance", comparing both lottery-admitted students and three groups of selection procedure participants, and concluding that "the lower dropout rate of selected students is related to both self-selection of participants before the start of the selection procedure and the academic part of the selection procedure."

In the present paper we present the research on the use of a supervised algorithm, namely a regression tree, to predict the score of admitted students in a private-run Spanish business school. The main target is understanding the effects of the features defined in the admission process to assess both the validity of the process and the final ranking of the student after one year in the school. After showing the scope of the research and the data and methodology in place, the analysis of both the descriptive statistics and the results from the regression tree will prove that the present admission process in place is working properly even if some fine tuning could be set in place for an even better performance.

2. Scope of the research

In order to meet the requirements of the present research, we've accessed the data of the admission process of the students who applied, were selected and finally enrolled Colegio Universitario de Estudios Financieros (CUNEF), a private business school affiliated of Universidad Complutense de Madrid (UCM). As it's usual in Spanish private schools and universities, students must pass an admission process further than the official University Access Test (PAU for its initials in Spanish, aka *Selectividad*). Since 2017, the test has been replaced by the University Access Evaluation (EVAU). Whatever the test passed, in both private schools and universities there are additional admission tools in which students must

show capacities normally not captured in their academic record and exceeding the usual academic skills assessed by the official university access test; anyway, the latter must be passed for a student being granted access in any official degree in Spain.

The admission process in place was built on different elements: an interview, a mathematical proprietary test, a reading comprehension test, a psychological test and the results the students achieved during their 3rd and 4th years of the Compulsory Secondary Education (ESO for its initials in Spanish). Other elements in place were the grade in their first year of the two-year baccalaureate and the type of baccalaureate followed. Given the national nature of the ESO and given that these two courses close a complete period (something the first year of baccalaureate doesn't accomplish), we have considered the average of this two years of ESO will depict a better image of the capabilities of the student, giving up the last two.

At the moment, according to the Universia web portal (http://www.universia.es/estudios/grados/dg/269), there are 2981 official bachelor's degrees in Spain; in the specific area of Business Administration, 137 certified schools teach the official bachelor's degree, both as a single degree (102) or along with a second one (35, the so-called double degrees). From the total number of schools teaching the subject, 90 are public and 47 are private-run: 11 in Madrid, 11 in Barcelona, 7 in Valencia, 4 in Alicante, 4 in Guipúzcoa, 3 in Valladolid, 2 in Ávila and 1 in La Rioja. According to the *Avance de la Estadística de Estudiantes* (Students' Statistics Preview) from the academic year of 2017-2018 (http://www.educacionyfp.gob.es/servicios-al-ciudadano-mecd/estadisticas/educacion/universitaria/estadisticas/alumnado/2017-2018_Av/Grado-y-Ciclo.html, Ministerio de Educación y Formación Profesional), during that year there were 96281 students enrolled in some Spanish university in courses conducting to a bachelor's degree in business administration (BBA); 80323 of them (83.4%) through in-person classes. 16.9% (13557) of the last figure were taking courses in private-run universities. In the affiliated centers, all of them with in-person classes, there were 6746 students and 5350 of them (79.3%) in some of the schools affiliated to public universities. If we just pay attention to those in their first year, and just considering the pure BBA studies (so neglecting other similar studies), we're talking about a total of 34144 students during the academic year of 2017-2018; of them, 27320 selected in-person courses and 5381 followed their first-year studies in some school in the autonomous region of Madrid. A tiny 19.8%, that is, 1066 of them, were enrolled in a private school or university (there's no breakdown for affiliated schools).

These figures account for the extreme competition the private schools are facing in the area of business administration. In that market, the demand meets private centers along with some quality public competitors with out-of-the-market prices that do not reflect the actual cost of the offered services. Private centers must then break the wall offering services (including, of course, the service of education, the most important from far but not the only

one) that must be perceived as better; just in that case, those demanding education will be ready to pay, in case they can afford it, an extra cost that can clearly be quite important. The fight for the "golden medal" in higher education has already become an obsession in Europe, as Bollinger (2005) reported for the United States. According to the *Boletín Oficial de la Comunidad de Madrid* (BOCM, 2018), the official tables of public prices for the degree studies with a level 3 in experimentalism (as those of BBA) show that the total cost for a 4-year, 240 ECTS (European Credit Transfer and Accumulation System, the official accounting system into the UE for degree's studies) credits BBA in Madrid (the second most expensive, just after the autonomous region of Catalonia) will add up to 5133.6 euros, in case the student needs no more than a single call and its retake. A single year in CUNEF is priced 10500 euros, the equivalent at Universidad San Pablo – CEU (https://notasdecorte.es/universidad-ceu-san-pablo) is 10860 euros, 11624,75 euros at Universidad Pontificia Comillas – ICADE (https://www.comillas.edu/grados/grado-en-ade-administracion-y-direccion-de-empresas-e2), and 21000 euros at IE University (https://www.ie.edu/es/universidad/admisiones/tasas-y-ayuda-financiera/metodos-de-pago/). The last three share the 28.2% of the total market of first-year students in a BBA in private-run Spanish universities.

3. Objectives and methodology

The targets of the present research are the following: starting from the available information from the admission tests (we leave the interview aside), we will try to ascertain what is the best mix of the variables in place to forecast the final score of the students when ending their first year in the BBA in CUNEF, as later explained; along with the mix, we also want to define the paths or decision rules allowing the best prediction. The main task is enhancing the tests in place and introducing improvements in the admission process, if any.

The research has followed the usual methodology of a data science project: definition of the question to be answered, data exploratory analysis, set-up and tuning of the model, achievement and analysis of the outcomes. The phases are depicted, in one way or another, in Peng and Matsui (2016), Hardoon and Shmueli (2013) or Provost and Fawcett (2013), among many others. Data come from the internal CUNEF data lake, and for the statistical processing we have employed R version 3.4.3 over RStudio version 1.1.414, the last available in the moment the research started; for the present review the versions were 3.5.2 and 1.1.463, respectively.

We have proceeded through classification and regression trees (CART) for discovering the main drivers of the process. Other approaches, such as the one by Hoefer and Gould (2000) were based both on traditional statistical techniques (linear and non-linear regression) and nontraditional – specifically, a neural network. Even if the latter was seeing as powerful by

the authors, we gave it up due to its difficulty in both implementing and understanding. In our case, and given metric variables, the regression trees are of interest. Initially introduced by Breiman, Friedman, Olshen and Stone (1984), this type of tools are likely the simplest to implement and interpret among classification algorithms. On their utility we can name the seminal work by Murthy (1998), the subsequent by Rokach and Maimon (2005) or the very new by Anandajayam and Sivakumar (2018).

Among the advantages of the technique, we must emphasize their ability to handle errors and missing value in the datasets, and the fact that they are nonparametric, meaning that there are no assumptions about the space distribution and the classifier structure. On the other hand, there are some disadvantages, being the most cited the possibility of overfitting due to the high flexibility of the technique (Pandya and Pandya, 2015; Ye and Hou, 2018; Fratello and Tagliaferri, 2019).

4. Analysis

Our dataset consists in the 313 students of the years 2015 and 2016, all of them finally studying a single bachelor's degree in business administration (BBA) in CUNEF, both in its bilingual English-Spanish version or the single Spanish one. For the present research, we considered their gender, their results in the mathematics test, the comprehension reading and the psychological ones (all together properly averaged into the variable NOTAPBAS, *score*), along with their final grades in the 3rd and 4th courses of the Compulsory Secondary Education (ESO for its initials in the Spanish official naming, *Educación Secundaria Obligatoria*, averaged into PBAESP2). The students have been classified according to their results in the 10 different subjects that define the official syllabus of the Universidad Complutense de Madrid (https://economicasyempresariales.ucm.es/estudios/grado-ade-estudios-estructura). The final grades of the student in each subject have been weighted according to the call the student has passed the exam: 1 if in the first one, .75 if in the second, .5 if in the third and .25 if in the fourth one. Given that the admission tests under scrutiny took place during the first semesters of years 2015 (for those entering the university September that year) and 2016 (for those entering September 2016), and that the research was originally conducted during the last three months of 2017, the maximum span of any student is two years in the same subject, giving a maximum of four calls for any subject. Those who entered in September 2016 accounted for a maximum of two calls for the same first-year subject.

Once we provided our 313 students with their final grade in the 100-points scale, we proceeded to sort them, defining three groups for the task of the present research: those in the top quartile (top 25), those in the first decile (bottom 10), and those in the middle of them, the so-called main group.

4.1. Descriptive statistics

For the total of the 313 students in the sample, 132 (42.2%) were women; the ratio holds for the students in the bottom 10 (13 of the total 31 were women) but completely reverse in the top 25, where 44 of the total 78 were women, a 56.4%. According to their academic provenance, the outcomes were, again, not surprising. In Spain, there are four different possible baccalaureates (humanities and social sciences, technology, natural and health sciences) that allow a student entering the university; the first one is the usual way to enter a BBA, and that is the case for the 78.3% of the sample versus 69.2% for those in the top 25 and 77.4% in the bottom 10 (non-significant difference from the main group); just 13.7% of the students in the main group came from a technical baccalaureate versus the 23.1% coming from the same one in the top 25 and 10% in the bottom 10; 6.7% from the one in health studies in the main group versus 7.7% in the top 25 and 6.5 in the bottom 10 (non-sig); and if a mere 1.3% from the one in arts live in the main group, there were none in the top 25 and 6.5% in the bottom 10.

The difference arises then between the top quarter of the students and the main group more than from the bottom decile and the latter: in the first case, we have more girls (1.3 vs 0.73 per boy in the main group) and a higher ratio of students coming from more technical baccalaureates: the general ratio of 3.8 humanities and social sciences per science student fall down to 2.25 in the top 25%.

The average score for the students at the end of the first year is 57.07 points (95% confidence interval -95% ci- 55.13 - 59.07) compared to 77.89 in the top quarter (95% ci 76.62 – 79.17) and 23.34 in the bottom decile (95% ci 18.90 – 27.78); their results in the ESO grade are 6.93 (in a 10 points scale, 95% ci 6.83 – 7.03), 7.6 for the top quarter (95% ci 7.38 – 7.83) and 6.28 (95% ci 6.00 – 6.56) for the lower decile. So there clearly exists a difference in terms of ESO grades between the three groups. And the presence of this difference along with the gender, in terms of academic performance, pushed us to analyze the issue through classification and regression trees.

4.2. The regression tree

Starting from our 313 complete observations, we build a regression tree where we try to predict the value of the end-of-year-one score from the values of gender (SEXO), average score in tests (NOTAPBAS) and average of third and yearth courses of ESO (PBAESP2). We used libraries rpart (recursive partitioning for classification, regression and survival trees, "an implementation of most of the functionality" of Breiman, Friedman, Olshen and Stone, 1984) and rpart.plot (for plotting 'rpart' models libraries). After pruning the tree, for avoiding overfitting, where the complexity parameter (cp) meets the minimum cross-validated error (xerror), starting at an initial level of cp_i = 0.174943 we are able to diminish it to a more suitable level of cp_f = 0.018036, after just 3 splits. As it's known, the

best cp value is the one that minimizes the prediction error RMSE (root mean squared error). The variables in the final model are just NOTAPBAS and PBAESP2, with an importance of 57% and 43% respectively, showing that the internal tests conducted at CUNEF overperformed the average score of the secondary years. As Figure 1 depicts, for the 7% having a score over 8.2 in the internal tests (bottom right node, D), the predicted average score at the end of year 1 will be 78.52 points (rounded to 79 in the figure). The decision rules are easy then to interpret: apart from the latter, for those in the range of 7.4 to 8.2, the average score will be 64.48 points (node C). The 87 students with proprietary admission test score above 7.4 (nodes C and D) represent 27.8% of the total sample; among them, the minimum PBAESP2 value in 6.36. The lower 10% of this one, accounting 32 students, is built according to one main condition: whatever the score in the admission tests, if the average grade in the 3rd and 4th years of ESO is below 5.8, the average score ending 1st year of the BBA in CUNEF will be 40.12 points out of 100. As we can observe, there's a light difference between the scores in the sample and those (node A) predicted by the regression tree: the lower decile shown an average PBAESP2 of 6.28 points vs the predicted 5.8 by the regression tree.
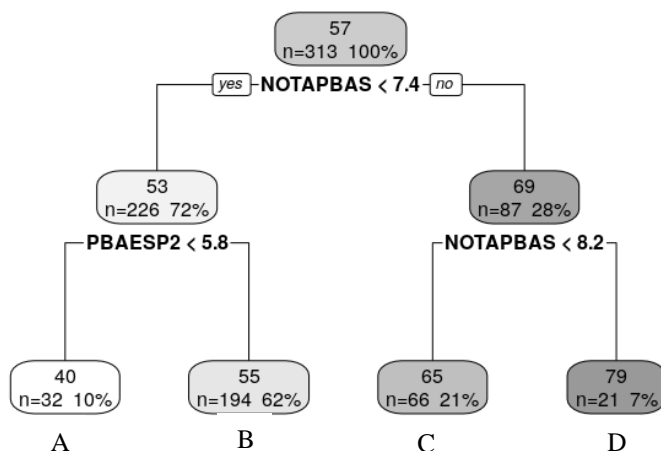
Figure 1. Final regression tree.

5. Conclusion

As we have shown along the present research, regression trees can be of help in the admission process. They are useful in defining the important variables (gender, even if not suitable for use according to a non-discriminating protocol, was wrongly presumed as a keystone) and they present clear, easy-to-follow decision rules for the management. In our case, they have also proven the importance of the admission tests as a feeding element above the official grades the students bring in their portfolio. Some problems have arisen, nevertheless, the most important one being the difference in the average grade that defines the lower decile of students in terms of their compulsory secondary education scores in 3rd and 4th courses. This is certainly due to an unavoidable fact: the small size of the sample, that prevents its correct split into a training set and a test one, essential for building a machine-learning model. Future work, along with a higher size, will observe additional possibilities according to new variables as the sending school; this will help to improve the definition of the decision rules in the pursue of excellence.

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Competencies and higher education: evidences and returns. The TECO project

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Abstract

The aim of this work is to present the state of progress and the main features of the TECO (TEst of COmpetence) project, promoted by the (Italian) National Agency for the Evaluation of Universities and Research Institutes with the aim to assess students' learning outcomes in the higher education contest. The results of the 2017-2018 TECO survey (which involved voluntarily over 12,500 nursing, physiotherapy and medical radiology students), showed that attending a university programme makes a difference in development of some competencies, especially for the disciplinary sphere. The analysis will focus on the connections between the characteristics of the students at the beginning of their study career and the achieved level of tested competences.

The return of the test results to the students and study programmes' coordinators will be presented and discussed, considering their possible uses in a self-assessment perspective.

TECO results and the new indicators that will be originated from this project could prove to be reliable tools for university programmes self-assessment, encouraging the use of evidence-based strategies for higher education improvement.

Keywords: higher education assessment; self-assessment tools; learning outcomes indicators; generic competencies; disciplinary competencies.

1. Introduction

The Test of Competence (TECO) project, promoted by the National Agency for the Evaluation of Universities and Research Institutes (Agenzia Nazionale per la Valutazione del sistema Universitario e della Ricerca - ANVUR), has the aim to develop indicators about the students' learning outcomes, as part of the teaching & learning assessment included in the National accreditation system (called Autovalutazione – Valutazione periodica – Accreditamento, AVA) of study programmes and universities. Those indicators are meant to be used as tools for the self-assessment activities and to inform the governance of higher education institutions.

In the following, the TECO project will be presented, as well as evidences from the last – and so far, the broader - survey (2017-2018). Finally, the return of results to the participating students and study programmes will be described.

2. TECO project: aims and instruments

TECO project has been developed in Italy by ANVUR since 2013. The Agency, among its duties (established by its institutive Presidential Decree - DPR 76/2010 - and the subsequent decrees issued by the Italian Ministry of Education, University and Research), received the mandate to define new indicators about the students' learning outcomes, as part of the teaching evaluation scheme that includes self-assessment, periodic evaluation, and accreditation of study programmes and universities (AVA). In this framework TECO project aims to the assessment of students' competences, as a proxy for the learning outcomes.

The first TECO trials, between 2013 and 2015, availed for the evaluation of Italian undergraduates' learning outcomes of the CLA+ test[1]. These experiences bared several shortcomings: a selection bias, weak interrater correlations and weak correlations between open and closed questions rates, in addition to the high cost of the procedure (see Ciolfi et al., 2016; Damiani et al., 2016; 2017). Thus, in 2016 ANVUR revised the whole project: from the domains of assessed competences to the methodology adopted.

To date, two branches of TECO have been developed, pointing toward the assessment of generic (TECO-T, where T stands for *trasversale*) and disciplinary (TECO-D, with D standing for *disciplinare*) competencies. Generic and disciplinary competences are conceived in a broad perspective, in line with the Definition and Selection of Competencies

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[1] The CLA+ test, produced by the Council for Aid to Education (CAE), is meant to measure the students' performance on analysis and problem solving, scientific and quantitative reasoning, critical reading and evaluation, and critiquing an argument, in addition to writing mechanics and effectiveness. It was administered twice: during 2013 in collaboration with 12 universities and during 2015 in collaboration with 24 universities (see Ciolfi et al. 2016; Ciolfi & Sabella, 2017).

(DeSeCo): «a competence is more than just knowledge or skills. It involves the ability to meet complex demands, by drawing on and mobilising psychosocial resources (including skills and attitudes) in a particular context» (Rychen & Salganik, 2003).

Undergraduates can develop generic competencies during their university career, independently of the specific study programme. The TECO-T items are produced in house by ANVUR, in collaboration with academic experts and in the wake of several international studies[2]. Disciplinary competencies are conversely strictly linked to a given study programme, therefore the related TECO-D are developed by working groups made up of representatives of the scientific societies of the discipline[3].

A strong impulse to the project has been provided in 2017, when the *progress tests* already used by three healthcare profession study programmes (Nursing, Physiotherapy and Medical radiology) voluntarily underwent a validation analysis by ANVUR and a subsequent item revision, to be adopted as three different TECO-Ds (one for each programme). From late 2017 until early 2018, the TECO-D of these three study programmes was delivered to about 12,500 students from 27 Universities[4].

Accordingly to the main purposes of the project, the value-added approach has been adopted – whereby both the competences of ingoing (first-year students) and outgoing (third-year students) first cycle university students are assessed. In perspective, each coordinator of a study programme should consider not only its students' absolute results in comparison with those achieved by students from other universities, but also, and more interestingly, the change occurred from the initial conditions.

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[2] For instance: the Six Subject Survey, the Progress in International Reading Literacy Study (PIRLS), the Trends in International Mathematics and Science Study (FIMMS and TIMSS), the International Civic and Citizenship Education Study (ICCS) endorsed by the International Association for the Evaluating of International Achievement (IEA); the Programme for International Student Assessment (PISA) and the Programme for the International Assessment of Adult Competences (PIAAC), by the Organisation for Economic Co-operation and Development (OECD). Should also be considered the Assessment of Learning Outcomes in Higher Education (AHELO), dedicated to learning outcomes in higher education.

[3] ANVUR supervises each TECO-D working group's activities and provides dedicated methodological and technical support. All the TECO tests undertake a validation procedure, including at least one field trial. The commitment in the project is voluntary.

[4] A total attendance of 12.510 students, of whom 3.993 (31.9%) carried out the paper and pencil version of the test rather than on the online platform managed by CINECA, an interuniversity consortium that offers support to the research activities through supercomputing and its IT applications.

3. Evidences on competencies development in higher education

The 2017-2018 TECO survey, involving students enrolled in Nursing, Physiotherapy and Medical radiology programmes in different universities across the Country, is by far the largest assessment of university students' competences accomplished in Italy to date. In addition to one of the three available TECO-Ds, each of the participants performed also two generic competences tests[5]: *Literacy* and *Numeracy*.

Literacy items[6] are meant to evaluate the undergraduates' levels of understanding and reflecting competencies on a text with a generic content. *Numeracy* items[7] assess undergraduates' levels in logical thinking and solving quantitative problems. Generic competencies scores were calculated considering all the participants'; disciplinary competencies scores were calculated separately for each TECO-D[8].

The participation to the 2017-18 survey was less extensive for the Nursing programmes, which have usually more students and different locations per programme (see Table 1).

Table 1. Participation to the 2017-18 TECO survey: performed tests by year and discipline, total number of students enrolled in the participating programmes, participation rate

	Performed tests				Enrolled students	Partecipation rate
	1 year	2 year	3 year	Total		
Nursing	4,553	2,088	2,740	9,382	24,110	38.9%
Physiotherapy	585	513	659	1,757	2,680	65.6%
Medical radiology	330	221	350	901	1,281	70.3%

The following analysis focus on the connections between the identified competences and the characteristics of the students at the beginning of their university studies. In order to reduce the risk of distortions, these analyses consider only the first-year students enrolled in 2017-2018 and the third-year students enrolled in 2015-2016, who have completed all the three parts of the TECO: *Literacy*, *Numeracy* and one of the TECO-D (Table 2).

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[5] For two others ambits the design process was ongoing. At present, the frameworks of Problem Solving (see ANVUR, 2019), and Civics tests have already been defined, with the items of the former to be validated in spring 2019.

[6] The test contains two types of items: the former require participants to complete 10 closed-answer questions after reading a text, in the latter they have to complete a short text with 20 words that are missing (Cloze test), for a total of 30 items.

[7] This test provides for a short text that includes graphs and tables, followed by five questions, an infographic followed by five questions, and 15 short logical reasoning questions, for a total of 25 items

[8] Two parameter IRT models were used. All the scores are standardized on a scale with mean 200 and standard deviation 40, to simplify the comparison.

Table 2. Complete tests by year and discipline, for the first-year students enrolled in 2017-2018 and the third-year students enrolled in 2015-2016

	1 year	3 year	Total
Nursing	4,185	1,625	5,810
Physiotherapy	422	385	807
Medical radiology	241	228	469
Total	4,848	2,238	7,086

Finally, the methods for returning the TECO results to the participating students and to study programmes' coordinators will be presented, discussing the possible uses in a self-assessment perspective.

3.1. Generic competencies

From an analysis by cohort, the outcomes on generic competences appear to be narrow but significant (Figure 1; for a more broad analysis see Ciolfi & Sabella, 2018).
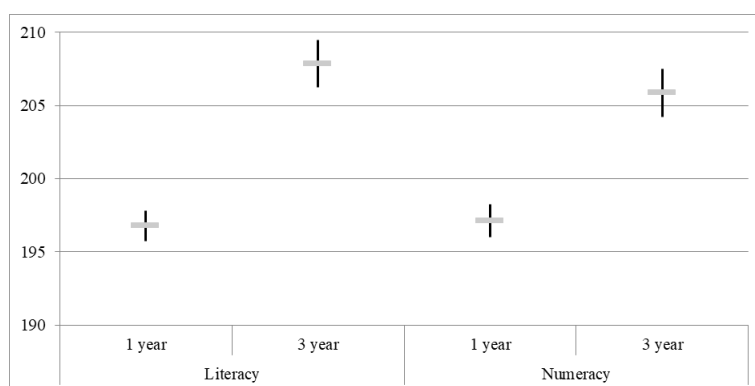
Figure 1. Generic competences scores: mean and confidence interval ($\tilde{x}\pm std.err.$) by enrollment year

It is worthy to consider the generic competences in the light of the characteristics of the students at the beginning of their university studies. Further, the disciplinary competence will be examined from the same perspective. The regression models in Table 3 contemplate as possible explicative factors the enrolment year, the gender, the age, the type of high school attended (School of origin), the high school's final grade and the social-cultural status[9].

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[9] Social-cultural status index, inspired to the Economic, Cultural, and Social Status (ESCS) used in the OECD-PISA reports (even if without the home possession dimension). It is obtained using a principal component analysis on the parents' higher occupational

Some of these evidences could lead to a cumulative advantage hypothesis ("the rich get richer, the poor get poorer")[10], which however would require a more detailed study on longitudinal data by cohort. The effect of the enrolment year is accompanied by other significant effects related to the gender and the previous education studies (for *Numeracy*, the social-cultural status also).

Table 3. Regression models for Literacy and Numeracy scores by: enrolment year, gender, age, school of origin, final grade and social-cultural status – coefficients, sig., N. and R-squared

		Literacy	**Numeracy**
Enrollment year	3 / 1	8,570***	8,791***
Gender	Female / Male	-4,598***	-3,412***
Age	20-21 / under 19	-1,531	-3,412*
	22-23 / under 19	-0,022	-6,277**
	over 24 / under 19	-1,66	-9,589***
School of origin	High school / Tecnical school	8,129***	8,696***
School final grade	High / Low	7,789***	8,527***
Social-cultural status		0,967	1,538**
Constant		194,95***	206,631***
N		4.584	4.584
R-squared		0,0345	0,0624

*p<.05, **p<.01, ***p<.001

3.2. Disciplinary competencies

The effect of university studies on disciplinary competences results significant and far more consistent, if compared with the effect on the generic competences scores (see Figure 2).

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status (scored according to Ganzeboom & Treiman, 1996) and the parents' higher number of year of instruction (the proportion of variance explained by the extracted component is 70.7%).

[10] This hypothesis would diverge from earlier works concerning the TECO administration of the CLA+ test (Ciolfi & Sabella, 2017).
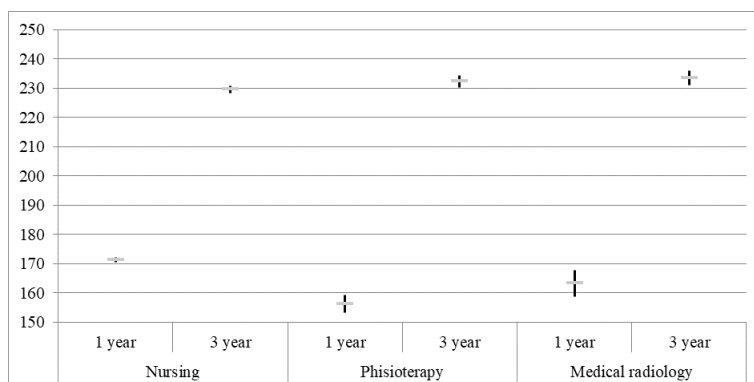
Figure 2. Disciplinary competences scores: mean and confidence interval ($\tilde{x}\pm std.err.$) by enrollment year

The regression models in Table 4 point out, besides the relevance of the enrolment year, also the lack of significance of almost all the other factors, with few exceptions (i.e. school final grade and age for Nursing; school final grade and gender for Medical radiology).

These results are extremely encouraging, especially considering the wide effect of higher education studies, regardless of the students' characteristics at the beginning of their course. As mentioned above, the TECO-D for nursing, physiotherapy and medical radiology study programmes were delivered because the corresponding working groups were the first to join the project. Currently, other disciplinary working groups, such as literature, philosophy, pedagogy, psychology started developing a TECO-D.

Table 4. Regression models for the disciplinary scores by: enrolment year, gender, age, school of origin, final grade and social-cultural status – coefficients, sig., N. and R squared

		Nursing	Phisioterapy	Medical radiology
Enrollment year	3 / 1	60,459***	70,159***	66,482***
Gender	Female / Male	-2,078	2,989	-7,898*
	20-21 / under 19	4,577***	4,989	7,318
Age	22-23 / under 19	0,967	4,0129	11,411
	over 24 / under 19	3,632*	4,013	11,01
School of origin	High school / Technical school	-0,908	1,043	0,708
School final grade	High / Low	5,835***	-0,380	15,608***
Social-cultural status		0,035	3,799	-0,884
Constant		67,468***	150,836***	153,264***
N		3.726	565	293
R-squared		0,4514	0,6649	0,6079

*p<.05, **p<.01, ***p<.001

3.3. Return of TECO results

The results of each TECO survey are made available to all attending students and their study programmes' coordinators. Students receive, on request, their personal results together with clear reference points to compare them (i.e. the mean score obtained by students with a similar profile). The certificate of attendance presents, for *Literacy* and *Numeracy* TECO-T: the score obtained the average score of students of the same enrollment year, the average score of students of the same enrollment year and university. For the TECO-D, the row score by topic is presented, along with the reference averages.

Table 5. Overall reference data for the participating programmes, simplified example table containing only the average score per cohort and study programme

Cohort*	Nursing			Phisioterapy			Medical radiology		
	Lit.	Num.	Disc.	Lit.	Num.	Disc.	Lit.	Num.	Disc.
1 year, enrolled before 2016	208	208,8	175,9	181,2	154,3	176,4	215,2	238,8	191,3
1 year, enrolled in 2016	207,7	223,3	167,6	188,2	192	166,4	210,2	224,8	134,1
1 year, enrolled in 2017	**206,2**	**220,1**	**159**	**194,8**	**195,3**	**175,3**	**205,9**	**210,6**	**163,2**
2 year, enrolled before 2015	189,7	213,7	204,5	187,4	195,1	216,9	-	-	-
2 year, enrolled in 2015	209,8	227,7	215,7	179,3	175,4	211,5	211,1	220,6	179,1
2 year, enrolled in 2016	209,6	225,9	207,9	190,7	193,7	221,2	207	222,1	196,7
3 year, enrolled before 2014	206,6	210,3	231,3	191	190,9	241,6	204,6	203,8	219
3 year, enrolled in 2014	209,6	212,4	236,6	197	191,6	242,1	217,4	226,7	241,6
3 year, enrolled in 2015	**207,7**	**220,2**	**233**	**197,7**	**194,5**	**236**	**213,8**	**225,8**	**232,3**
Total	206,9	219,4	203	191,9	190,7	207,6	210	221,2	201,1

*Cohorts that include too few students are obscured out for privacy protection reasons.

Regarding the return of results to study programmes, the goal is to give useful information for self-assessment purposes. Each university receives its own microdata (suitably anonymized and obscured to prevent the identification of students) and a table presenting the overall reference data. The latter are referred to all the participating programmes and are presented by cohort and study programme: the average scores for each competence tested, the average number of correct answers for each thematic area of the disciplinary test and the total number of attendees (see as a simplified example – containing only the average scores – Table 5) are made available.

4. Conclusions and remarks

The attendance to a university study programme makes a difference in the development of some competencies, especially for the disciplinary sphere. TECO project results could be reliable tools for university programmes self-assessment, to be used for evidence-based strategies in higher education improvement.

The return of the TECO results aims at helping the programmes' coordinators to initiate or deepen the reflection about the generic competence development, by providing a broader information framework on the profile of their students. The project intends to contribute to

the analysis of the strengths and weakness of the offered disciplinary training, helping the reflection on the possible improvement interventions, with respect to the planning and implementation of the programmes.

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Leader-Follower dynamics within medical students' groups during clinical rotations

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Abstract

Clinical practical training is a common practice and a requirement for many medical professions in the U.S.A. This training often lacks in managerial and leadership training, leaving many future practitioners poorly prepared for the challenges and requirements of leadership roles. The complexity of the healthcare system brings about new challenges in terms of leadership, with the development of leadership skills for practicing physicians becoming even more crucial. This study analyzed a sample of students and resident doctors in a psychiatric setting during their clinical rotation. The particularities of the observed emergence of leadership within the scope of multiple theoretical frameworks in the field of leadership were analyzed by calculating the median values of each set of survey responses. The study found that biological sex did not play a significant role in Leader emergence (p=0.74), Followers scored Leaders highly overall, and Leaders showed that they had a solid insight into their own capacities and limitations. Overall, strong leadership qualities were identified across all theoretical frameworks with valuable implications for the development of future leadership training. More research is needed to test this methodology in different medical settings and to identify the most effective type of leadership training for clinical education.

Keywords: Leadership; authentic leadership; medical education; healthcare management; leadership training; public health.

1. Introduction

Clinical practical training is a common practice and a requirement for many medical professions in the U.S.A. Depending on the profession and specialization, clinical training can last anywhere from 1 year to 8 years. Clinical experiential training lacks in managerial and leadership training, leaving many future practitioners poorly prepared for the challenges and requirements of leadership roles (Ackerly, et al., 2011). The complexity of the healthcare system brings about new challenges in terms of leadership, with many experts speaking up about the need to develop leadership skills for practicing physicians (Stoller, 2008; Stoller, 2009; Stoller, 2013; Blumenthol et al., 2012; Detsky, 2010; Anderson & Garman, 2014; & NCHL, 2014). Given the training that physicians, non-physician practitioners (N.P.P. – i.e. Physician Assistants and Nurse Practitioners) and other health care providers undergo, they present a viable population to undertake leadership roles in clinical care, improving the healthcare system, prioritizing patient care and effectively managing clinical settings (Gunderman & Kanter, 2009), achievable with comprehensive leadership training.

The present paper analyzed a sample of students and resident doctors in a psychiatric setting during their clinical experiential rotation over a one-year period for Followers, and a two-year period for Leaders, due to sample size limitations. The size and multi-institutional characteristics of the sample, as well as the particularities of the setting, offered fertile ground for the emergence of organic leadership traits within the group of present and future practitioners. Leaders and Followers were identified and separated for analysis, applying two series of leadership scales; one for Followers and one for Leaders. The aim of this study is to measure the particularities of the observed emergence of leadership within the scope of multiple theoretical frameworks in the field of leadership. The setting surveyed utilizes a management strategy for the educational component that has shown to generate an annual net saving of $118,299.45 with an initial investment of $11,170.88 (Whiteman et. al, 2018). Identifying leadership nourishment properties within the same strategy would add educational value to an already financially viable strategy.

The sample surveyed does not include all forms of practitioners in the medical field and should not be considered an absolute for the totality of practitioners. As explained in the setting, 35 of the 42 of the educational programs relate to physician assistant studies, with the rest spread between 5 M.D. and D.O. programs and 2 post-graduate residency programs. Due to the overwhelmingly large proportion of P.A. students in the study, the results may be more representative of this subset of the sample.

1.1. Research Background

The emergence of student Leaders occurred in an organic, unplanned manner. Initially, the facility had a small number of local affiliations which accounted for 0-3 students in a

regular rotation block. Most students came from one educational facility, providing no overlapping of rotations. By the end of 2014, the pool of students had expanded to include out-of-state institutions and P.A. programs. As a result, the number of students gradually increased, and their rotations started to overlap. Over time, as the number of students grew, the medical director and the clinical education coordinator started to identify, within the student group, individuals that would take it upon themselves to guide new students, propose improvements to procedures within the students' office and direct other students. Some of those individuals would openly express their disposition. Another noticeable factor was that students would allocate and centralize between themselves a person to organize their workload, modifying it based upon new student arrivals and students exiting upon completing their rotation. Both the medical director and the clinical education coordinator identified advantages into openly recognizing a student as Leader within the group.

Currently, student Leaders within the setting are not selected solely by their peers nor their preceptor. They are also not selected solely on the basis of merit, skills or knowledge. Selecting student Leaders contains a strong time component. Student Leaders are commonly selected by the acting student Leader after leveraging their abilities, aptitudes and remaining time in the rotation. Students with a longer remaining term in their rotation acting as Leaders will likely provide more stability than a student who only has a week or less to finish her/his rotation. The best candidate will be selected in a joint decision between the acting student Leader and the medical director. In some instances, there can be a secondary student Leader supporting the first student Leader. In other instances, the medical director will select the student Leader by himself; this occurrence tends to happen as a result of not having any overlapping students and all present students having no experience.

1.2. Leaders' Role

The leadership role presents the opportunity to enhance the experience of all the students. Clinical education rotations are meant to provide students with hands-on experience in each medical specialty. It is also a "real-life" simulation where students get to experience the every-day working characteristics of each specialty and their settings while under the constant supervision of their preceptor, allowing them to have a "safety-net". Inserting a student Leader enriches the "real-life" experience for all the students by adding a layer of support and guidance. The role of the student Leaders is mainly for communication purposes. Student Leaders serve as a bridge between the clinical education office and the students' offices, acting as a funnel to distribute necessary information. Student Leaders also help the medical director and preceptor ensure that all students have an equitable overall experience (patient load, initial psychiatric evaluation presence, group support, etc.).

It is relevant to point out that there are several layers within the students' role as a whole. Beyond the Leader-Follower relation, there are other support activities that all students participate in. On the first days of their rotation, students are matched by the student Leader with other students that have more experience with the facility. The purpose of this grouping is to have the experienced students familiarize the new students with the Electronic Medical Records (E.M.R.) system, other tools, and the facility layout. What the experienced student shows the new student has no direct repercussion on patients or patient care. None of the training or guidance provided by the experienced student has any clinical value or is directly related to patient care. However, the instructional value is high, as all students need to learn their way around the E.M.R. network and facility in order to effectively complete their duties. The medical director constantly supervises the training to ensure that no clinical indications are given.

The presence of a leadership position within the students' office does not undermine the influence or supervision of the preceptor towards the students. As part of the educational strategy, supervision from the preceptor aims to be seamless in order to encourage a more participative role from the students and help them develop their skills as providers in a transparent alignment with their own individual qualities and skills. The student Leaders do not supervise the work of the Followers in place of the preceptor; their role is to facilitate and support both the Followers and the preceptor.

2. Methodology

2.1. Setting and Sample

The setting used for this study is the psychiatric residential facility, Family Center for Recovery (FCFR), which has a total of 44 in-patient beds. Levels of care at the facility include: Intensive Detoxification (Detox), Residential Hospitalization, Partial Hospitalization (Day or Night with Community Housing) (PHP), Intensive Outpatient (IOP), and Outpatient (OP). FCFR also maintains these same levels for pregnant and adolescent patients, except for Detox in the case of adolescents. FCFR treats all levels and types of mental illnesses across the spectrum. The residential facility is privately-owned and managed by the medical director in-charge, Dr. Robert A. Moran M.D., a triple board-certified psychiatrist. The setting analyzed holds, as of 2018, a total of 5 Medical school affiliations, 35 Physician Assistant program affiliations and 2 residency program affiliations. Only a small proportion of the educational affiliations are local, with a large percentage being from a state different than that of the preceptor. In 2017, FCFR precepted a total of 223 students distributed as follows:

Table 1. Distribution of students

January	25 Students	May	20 Students	September	17 Students
February	16 Students	June	9 Students	October	28 Students
March	14 Students	July	16 Students	November	38 Students
April	19 Students	August	15 Students	December	6 Students
AVERAGE = 18.58 Students/month					

The distribution only marks the month in which their rotation started. However, particularities within different medical education programs create overlapping rotations.

The number of professionals trained during the period analyzed (2017) includes 3rd and 4th year M.D. and D.O. students, Physician Assistant (P.A.) students, and M.D. and D.O. resident doctors. Rotation durations were between 4-6 weeks, with a few instances where students and residents selected both a mandatory and an elective rotation with FCFR, which then totaled beyond 6 weeks in one continued block or two separate blocks within the year. Rotation blocks from different educational programs have different starting dates based on the particularities of each program and traveling requirements for students.

2.2. Scales methodology

For the purposes of this paper, the population was analyzed separately by group (Followers and Leaders). Only Followers whose rotation block started between January 1st, 2017 and December 31st, 2017 were analyzed. In the case of the Leaders, given the limited number of Leaders within a year, the Leaders from January 1st to December 31st, 2016 and 2017were analyzed.

In order to assess the Leader-Follower dynamics, surveys were developed for the student Followers and for the student Leaders. The surveys for student Followers contained modified versions of the Leadership Trait Questionnaire (LTQ), Leadership Behavior Questionnaire, and Team Excellence and Collaborative Questionnaire. The surveys for the student Leaders contained modified versions of the Skills Inventory Assessment, Path-goal Leadership Questionnaire, Authentic Leadership Self-Assessment Questionnaire, and the Team Excellence and Collaborative Questionnaire. All surveys were adapted from similar questionnaires found in Northouse (2016). The surveys utilized may not be comprehensive enough to stand as definitive measures of leadership frameworks but are intended to assess the qualities of the Leaders in this study. An extra survey was generated for the Leaders in order to identify any prior exposure to leadership training that might have played a relevant role in their performance. Some of the assessment tools utilized suggest cross- referencing between the Followers' evaluation of the Leaders and Leaders' self-evaluations; however, given the sample size, overlapping particularities and other issues, such suggestions were

not implemented. The only tool administered to both Leaders and Followers was the Team Excellence and Collaborative Questionnaire for comparison purposes. All surveys mentioned were modified in order effectively target the population.

2.3. Statistical significance

For the purpose of student Followers, 191 Followers were identified for 2017, after removing 7 instances of invalid duplicates and one case of missing records during the pre-survey screening. Strong control mechanisms were implemented to ensure that the rotation block of each surveyed student was from the sampled time frame and that no duplicate results were present. Of the total surveys sent to Followers, 163 responses were received, making for a response rate of 85.34%. Of the 163 responses, 9 were removed after being identified as student Followers whose rotation block was in 2016, 4 were removed for not providing their name, 3 were removed after their name did not match their records, 1 was removed after the student was identified as Leader, 1 was removed after being identified as a duplicate response, and 1 was removed after identifying that the student did not complete the clinical rotation due to natural disasters. After removing 19 responses post-survey from the 191 originally identified Followers, we obtained a final population size of 172 Followers and a final number of respondents of 144.

For the purpose of student Leaders, 24 were identified for 2017 and 11 were identified for 2016; by adding them a total of x=35 (n2017+n2016) was obtained. Of the 35, 4 were identified post-survey as not having taken the role of Leaders, leaving a total of x=31 Leaders for 2016 and 2017. The response rate for the Leaders' surveys was 100%.

Given the total number of respondents, the overall margin of error, at a confidence level of 95%, equals 8%.

To determine if biological sex had an effect on leadership emergence, an N-1 Chi squared statistical test was applied to the data, comparing the proportion of females in leadership roles to the proportion of females in the overall sample population, using Medcalc statistical software (Medcalcsoftware, 2018).

3. Results and Discussion

3.1. General Findings

Among the population findings, biological sex played no role in leadership. 74% of the Leaders in the sample are biologically female and 26% are biologically male. Within the entire sample population, both Leaders and Followers, 71% of the population were female and 29% were male. Biological sex, therefore, played no role in leadership emergence in this study (p=0.74) (Medcalcsoftware, 2018).

The distribution of titles within Leaders is 87% P.A. students and 13% D.O. medical students. No other degree type held the Leader title within the years 2016 and 2017. Overall, including Leaders and Followers, P.A. students represent 72% of the entire student sample. D.O. medical students represent 25.14% of all students, M.D. students only represent 1.14% of the total population while D.O. resident doctors represent 1.71%. The high incidence of P.A. student Leaders may be due to the large body of P.A. students, along with the fact that some of the P.A. educational programs have rotations of 5 and 6 weeks. Students and residents with longer rotations are more likely to be selected for the position of Leader within the group as previously explained. No M.D. resident doctors were identified during the surveyed period.

3.2. Followers' Findings

The first survey presented to the Followers was a modified version of the Leadership Trait Questionnaire (L.T.Q.), based on one of the earliest systematic approaches attempting to conceptualize and study leadership. The trait approach revolves around the traits Leaders exhibit. The tool suggests Leaders to self-rate; however, only the Followers were surveyed. The questionnaire utilized quantifies how Followers perceive the Leaders, focusing on measuring 14 traits. The median results for the traits Articulate, Trustworthy, Outgoing, Sensitive, Persistent, Dependable, Conscientious, Empathic, Friendly and Diligent were "Strongly Agree". While for the traits Self-assured, Perceptive, Self-confident and Determined were "Agree". The results for this scale highlight that Followers had a very positive impression of the Leaders for every trait analyzed.

The second survey was a modified version of the Leadership Behavior Questionnaire, which consists of 20 statements to assess the Leader's behavior in two orientations; task and relationship. The task orientation concentrates on how the Leader focuses on helping others understand and define their roles within the group and measuring how much effort Leaders put on letting Followers understand what is expected of them. The relationship orientation quantifies how much effort Leaders put into ensuring group cohesiveness and that every member feels comfortable within the group. Followers ranked the Leaders as "Very High" in both task and relationship orientations, showing that Followers saw their Leaders as very dedicated at both integrating them to the group and ensuring they are knowledgeable about their role and what is expected of them.

The third survey is a modified version of the Team Excellence and Collaborative Team Leader. This particular instrument was completed by both the Followers and the Leaders, with results compared to identify the areas of greatest weakness. The instrument measures multiple items within the Team dynamic: Clear Elevating Goals, Results-Driven Structure, Competent Team Members, Unified Commitment, Collaborative Climate, Standards of Excellence, and External Support and Recognition. It also measures multiple items within

the Leadership's performance: Focus on the Goal, Ensure Collaborative Climate, Build Confidence, Demonstrate Sufficient Technical Know-How, Set Priorities, and Manage Performance. Scoring is done on a spectrum which contains: false, more false than true, more true than false, and true. Overall, Followers felt confident in all items of the team dynamic, scoring them all as "true", with "Results-Driven Structure" being the only dimension to score as "more true than false". In regard to Leadership's performance, Followers showed strong confidence in all items.

3.3. Leaders' Findings

All Leaders were asked to complete a survey relating to prior leadership training. A total of 30 out of the 31 student Leaders identified for the time period of the study answered the survey. The 30 students encompass a total of 12 different educational facilities. 46.6% of the respondents reported participating in some form of leadership training prior to their rotation. The most common forms of training reported include lectures (7 responses), group dynamics (6 responses) and case discussions (5 responses). The most common provider of the training was their current educational institutions, some as part of their curriculum (3 responses) but most as part of extra-curricular options (8 responses). Other providers of leadership information include undergraduate institutions, conferences, and sports training. Length of training varied between less than an hour and 2+ years, with the most common answer being 1-8 hours (6 responses). 11 of the respondents reported their training as being provided in-person while 2 reported it as being provided online and 1 reported a combination of both. Group size for the training varied with 10-30 participants being the most common number (5 responses). An open comments section was left for student Leaders to express any information they thought was relevant to their leadership skills. It is worth noting that some respondents mentioned military experience and sports training as a contributing factor to their leadership skills. Overall, no systemic relevant previous training or environmental factors were identified.

The first leadership survey applied to the identified Leaders was a modified version of the Skills Inventory Scale. The Skills approach in leadership focuses on abilities and skills that can be acquired and reinforced by individuals. The scale utilized in this study assesses the Leaders in technical, human, and conceptual skills. Since the skills inventory scale is a self-assessment, the result expresses mostly the level of comfort of the Leader in technical, human, and conceptual competencies. Leaders ranked themselves high in all 3 competencies (expressed as a median). Results indicate that they felt confident guiding Followers in their technical duties and addressing their personal concerns. In the Skills theoretical framework of leadership, lower management levels require a focus on technical and human skills and, as we progress up in the management ladder, the weight switches in favor of conceptual skills, as it is essential in order to understand to grasp the complexity of

large organizations, their goals and overall big picture. The high results on all 3 competencies show Leaders comfortable to navigate all levels of an organization.

The second survey applied to Leaders was a self-assessment modified version of the Path-Goal Scale. The Path-Goal theoretical framework delves into how Leaders encourage productivity while also promoting engagement and satisfaction in their Followers (Evans, 1970; House, 1971; House and Dessler, 1974; & House and Mitchell, 1974). The instrument utilized measures the respondents in four different styles of leadership: Directive, Supportive, Participative and Achievement-oriented. The results of the scale provide the Leaders with insight into their weaknesses and strengths, as well as the emphasis they place in each style. The median scoring was "High" for Directive Style, Participative Style and Achievement-oriented Style. Supportive style was ranked as "Common".

The third survey was a modified version of The Authentic Leadership Scale. The scale is a self-assessment to help Leaders determine their own level within the authentic leadership theoretical framework. The scale measures the Leaders' foundation on Self-Awareness, Internalized Moral Perspective, Balanced Processing, and Relational Transparency. The median score was "Medium" for the Internalized Moral Perspective, Balanced Processing, and Relational Transparency, and "High" for Self-Awareness. Based on the scoring on each individual component, we can see that surveyed Leaders have a very valuable foundation from the authentic leadership theoretical framework. There is room for improvement, but the self-assessment provides a good understanding of the current state of Leaders. Overall, the results indicate that the Leaders have a solid insight into their own capacities and limitations.

The fourth survey is the modified version of the Team Excellence and Collaborative Team Leader questionnaire that was also applied to the Followers. In contrast to the responses provided by the Followers, the Leaders were more critical of the team dynamics, scoring Results Driven Structure, Standards of Excellence, and External Support and Recognition as "more true than false". All other aspects of both dimensions were scored as "true".

3.4. Implications of Results and Future Research

In all instances, Followers scored Leaders higher than Leaders scored themselves. Given the low previous exposure to leadership roles or training, the observed difference in scoring can answer to lower confidence in their own leadership capacities. A notable observation was made on the results for The Team Excellence and Collaborative questionnaire which was applied to both Leaders and Followers with similar results observed amongst the two groups, except for the Leaders scoring the team dynamics slightly lower than the Followers scored them. Given the direct impact that leadership holds over the team dynamics, and the specific items that were ranked lower, the factors that affect them are external to the control

of the Leaders. These lower scores can answer to a lack, or perceived lack, of structure within the medium that holds the team (upper management). The results, overall, portray a synergistic team stable across multiple Leaders.

Several particularities of the surveyed sample might play a role in the development of observed leadership skills. Given that the sample includes resident doctors, physician assistant students, and both third and fourth year medical students, there is an unmeasured level of inter-professional education that may play a role and even stimulate leadership dynamics. The overlapping characteristic of their rotations is a strong stimulant of inter-professional education. More experienced students were observed acting as a mentor for newer students in non-clinical aspects, aiding the newer students in familiarizing themselves with their new environment, policies and procedures that govern their activities.

Some students have anecdotally reported that interacting with students pursuing different degrees, or even the same degree but from different educational institutions, has been a positive professional reinforcement on their overall career and educational institution choice. Students from recently opened educational programs have reported a huge sense of relief after clinically interacting alongside students from more established educational institutions, as they have been able to assess their learned skills and knowledge against that of their colleagues. A substantial portion of the surveyed sample attended an out-of-state educational program, some attending their clinical rotation alone or with another student/s from their educational program. Being in a foreign place for their rotation inserts an added level of challenge and discomfort due to the absence of known locations and individuals, which stimulates interaction with other students in a similar position outside of the clinical setting, promoting interpersonal bonds, as reported by multiple students.

Student Leaders were also Followers at some point in their rotation, which allows Leaders to relate with the challenges, anxieties and limitations of their own Followers. The Leader-Follower dynamic is a synergistic relationship, and given the results obtained, the leadership traits observed appear to create strong team synergies.

All of these factors can potentially play a hard-to-quantify role in the observed emergence of Leaders. The results of this study suggest the possibility of effective leadership training during the experiential clinical rotations while also generating significant savings for the precepting facility (Whiteman et al., 2018). More research is required to corroborate the results obtained.

4. Conclusion

Leadership development in healthcare providers is increasingly becoming a necessity (Stoller, 2008; Stoller, 2009; Stoller, 2013; Blumenthol et al., 2012; Detsky, 2010;

Anderson and Garman, 2014; & NCHL, 2014). Some authors even stress the need for Leaders within institutions to be care providers (Gunderman & Kanter, 2009; Hillman, Nash, Kissick, & Martin, 1986; Cutler, 2009; & Boehmer, 2009). Whether executives and managers of healthcare facilities should or should not be trained healthcare providers (i.e. physicians) is a topic of much debate with several pros and cons. However, the results of the present paper provide an initial image of the leadership qualities that can be seen in healthcare providers in-training. The positive results show promising providers capable of taking active roles in leadership positions. Most of the training reported by emergent Leaders in this study previous to this experience was informal. A deeper, more focused leadership training may cultivate the leadership many authors call for. More research is needed to assess the particular areas to focus on and the type of training that would be more effective for clinical education.

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Improving Evidence-Based Practice education in healthcare courses: A Participatory Action Research multiple-case study

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Abstract

This paper synthesises the results of three participatory action research (PAR) studies undertaken to improve the integration of evidence-based practice (EBP) education in three undergraduate health courses at one Australian university: Bachelor of Nursing, Bachelor of Occupational Therapy, and Bachelor of Physiotherapy. The PAR process with interested academics uncovered a range of EBP education strengths and weaknesses in the three courses. Common themes were evident, which are likely to be applicable in other similar courses. Identified weaknesses included a lack of explicit teaching about the meaning, principles, steps, and importance of EBP, partly stemming from a lack of shared understanding. A relative lack of emphasis on certain EBP steps was also noted, particularly the first step of 'asking' questions. A lack of communication with workplace learning (WPL) supervisors about how to facilitate EBP was also noted, raising concerns about variable EBP-education quality across WPL settings. Opportunities for improvement were identified by academics in each course, across multiple subjects and year levels. In our experience, PAR has been a highly constructive approach to EBP curriculum improvement. We encourage consideration of a PAR approach for addressing similarly complex curriculum challenges.

Keywords: curriculum improvement; evidence-based practice; health care; undergraduate; action research; case study.

1. Introduction

Among contemporary EBP scholars (e.g., Hitch & Nicola-Richmond, 2017; Malik, McKenna & Griffiths, 2017; Murphy et al., 2018), evidence-based practice (EBP) is considered to be a client-centred, collaborative process of enquiry and reasoning to facilitate defensible healthcare decisions. EBP requires healthcare practitioners to recognise uncertainty, seek relevant evidence to reduce that uncertainty, and judiciously incorporate that evidence in their decision-making. Based on the Sicily Statement on EBP (Dawes et al., 2005), contemporary scholars recommend that practitioners enact EBP in five steps: (1) *Ask* – Recognise situations of uncertainty, and articulate that uncertainty as answerable questions; (2) *Acquire* – Find the best evidence available, if there is any, on those questions; (3) *Appraise* – Judge that evidence for its applicability to the practitioner's situation and its validity/trustworthiness; (4) *Apply* – Incorporate the evidence into their professional reasoning, along with their own and other clinicians' training and experience-based wisdom, their clients' values and preferences, and the practice context; and (5) *Assess* – Evaluate their reasoning processes and the outcomes of their decisions, and share their learning with colleagues if possible, to build practice-based evidence for the future. High quality EBP involves collaborative engagement with clients and colleagues (Drisko, 2017; Melnyk et al., 2010).

EBP is not routine for many practitioners, partly due to inadequate pre-service preparation (Rousseau & Gunia, 2016; Saunders & Vehviläinen-Julkunen, 2016). Integrating the five steps of EBP into the instructional and clinical experience of pre-service health practitioners is important for maximising their likelihood of engaging in EBP post-graduation (Brooke, Hvalič-Touzery, & Skela-Savič, 2015; DeCleene Huber & Nichols, 2015; Fiset, Graham, & Davies, 2017; Hecht, Buhse, & Meyer, 2016; Hitch & Nicola-Richmond, 2017; Malik, McKenna, & Griffiths, 2017; Saunders & Vehviläinen-Julkunen, 2016). Students' EBP confidence and pro-EBP attitudes are maximised when EBP skills are addressed in subjects beyond research-focused subjects, particularly in workplace learning (WPL) subjects (Murphy et al., 2018).

Research suggests that university curricula tend to predominately focus on acquiring and appraising research evidence – Steps 2 and 3 of EBP – without necessarily contextualising these processes as elements of EBP (Malik, McKenna, & Griffiths, 2017). This is problematic because, unless the skills involved in Steps 1, 4 and 5 are also emphasised through explicit instruction, the value of teaching students Steps 2 and 3 might be limited and the potential of EBP to enhance healthcare might continue to be compromised.

Despite its importance, there is little published research on the question of *how* EBP education can be integrated across the non-research focused subjects of a course, and how such integration can be improved in an *existing* curriculum. Enhancing EBP integration is a complex curriculum-improvement challenge, not amenable to a top-down, simple, one-size-

fits-all approach. Pre-existing strengths and weaknesses vary between courses. In addition, multiple stakeholders need to be involved in identifying, planning and implementing improvements, including academics who may not normally consider it to be their responsibility to teach EBP knowledge and skills.

This paper synthesises the results of three participatory action research (PAR) studies undertaken to improve the integration of EBP education in three undergraduate health courses at one Australian university.

Each PAR study aimed to:

- identify existing EBP education strengths in the course;
- identify weaknesses and opportunities to strengthen the EBP curriculum; and
- develop action plans that stakeholders felt were practical and worthwhile.

2. The three courses

2.1. Bachelor of Nursing

The 3-year Bachelor of Nursing (BN) course takes in approximately 450 students annually, across several campuses and online. This course satisfies the requirements for registration with the Nursing and Midwifery Board of Australia.

2.2. Bachelor of Occupational Therapy

The 4-year Bachelor of Occupational Therapy (BOT) course takes in approximately 80 students annually, across two campuses. This course satisfies the requirements for registration with the Occupational Therapy Board of Australia.

2.3. Bachelor of Physiotherapy

The 4-year Bachelor of Physiotherapy (BPT) course takes in approximately 130 students annually, across three campuses. This course satisfies the requirements for registration with the Physiotherapy Board of Australia.

3. Participatory action research methodology

We adopted an action research approach, which has been described by Reason and Bradbury (2006) as a *purpose* of enquiry where the aim is to acquire information with practical implications to solve specific, local, context-bound problems. Participatory action research (PAR) typically involves the researchers as stakeholders/contributors (Koshy, Koshy, & Waterman, 2011). Many PAR models exist, most of which include 'action' and 'reflection' phases (Koshy et al., 2011). Few models focus on steps to ensure the initially planned actions

are as promising as possible by engaging key stakeholders in the action-*planning* stage. Most models emphasise reflecting on the *consequences* of the planned actions. Our project involved stakeholders in data collection to inform an action plan to improve the EBP curriculum in each course. After sharing our literature-informed understanding of EBP with interested academics, we gathered and synthesised their insights and opinions regarding possible EBP education improvements in each course. Data was collected via individual interviews and/or focus groups. Draft action plans were proposed to the teams for further feedback and refinement.

4. Multiple case study methodology

Stake (2006) defines the multiple case study approach as studying multiple cases simultaneously or sequentially as a way of generating a broader appreciation of a particular issue. For us, the 'issue' was the challenge of improving undergraduate EBP curricula. As advised by Crowe et al. (2011), in this multiple case study, data collection was flexible enough to allow a detailed examination of the issue in each case, but broadly comparable to enable consideration of emerging similarities and differences in cross-case comparisons.

5. What EBP education was already occurring?

5.1. Bachelor of Nursing

In the BN, EBP was focal in a standalone research-focused subject in Year 3 and 'touched on' in other subjects. Particular academics taught and integrated EBP into their subjects very well. Generally, Steps 1 to 3 were believed to be covered in course work, and Steps 4 and 5 in WPL subjects; but this was often not explicitly named as EBP. In simulation labs, students practiced various steps of EBP; but not all steps, and they were rarely identified as EBP.

5.2. Bachelor of Occupational Therapy

A number of subjects in the BOT addressed EBP, and some academics were able to articulate EBP well. A multi-disciplinary research-focused subject in Year 2 identified the five steps of EBP, and links to these concepts were made in another Year 2 subject and in Year 3 journal clubs. Skills to acquire and appraise research evidence (Steps 2 and 3) were explicitly taught and assessed, including in a Year 2 assignment called 'Research Evidence in Professional Practice'. Oral viva assessments were conducted in Year 2 and 3 to give students practice in thinking dynamically and flexibly and articulating their decision-making. Some academics were particularly passionate about encouraging students to progress from black-and-white thinking, stimulating curiosity, and generally improving the EBP curriculum.

5.3. Bachelor of Physiotherapy

The BPT included the above-mentioned research-focused subject in Year 2, which covers the five steps of EBP. EBP education continued across the course, including in assessment tasks. BPT academics took pride in the way they modelled EBP to students, though they did not always name it as EBP. In Year 3, journal club sessions addressed some EBP skills, though not explicitly. There was also an awareness by academics that traditional EBP tends to assume a Western view of healthcare and knowledge generation, to the exclusion of other ways of knowing based on, for example, Indigenous and Chinese cultures.

5.4. Common themes

All three courses started with significant strengths: EBP already had a firm place in the curricula; some teaching staff were already quite knowledgeable and passionate about EBP; and a critical mass of staff in each teaching team showed enthusiasm towards finding ways to increase the effectiveness of the EBP curriculum.

6. What weaknesses and opportunities were identified?

6.1. Bachelor of Nursing

The BN academics agreed that EBP should not be consigned to a standalone subject delivered in Year 3. Based on the backgrounds and characteristics of the academics, variability was noted between subjects in terms of how well EBP was articulated. EBP steps were rarely labelled as such or explained in terms of their interrelatedness with the other steps. There was a perceived need for greater consistency between subjects/academics through more explicit reference to the principles and processes of EBP in subject documentation.

6.2. Bachelor of Occupational Therapy

The BOT academics identified inconsistencies in the meanings they attributed to EBP. They felt that, when EBP was covered, the focus was too much on research evidence, to the exclusion of other types of evidence. They also felt students needed more direct instruction and opportunities to practice the full range of skills involved in EBP. In particular, it was felt that more could be done to foster a spirit of enquiry (Step 1). The focus seemed to be on Steps 2 and 3, with academics performing Step 1 for the students. EBP seemed to be mainly addressed via assessment tasks; not so much via explicit instruction or modelling. There was a perceived lack of connection by students between client-centred practice and EBP. There was also a perceived blind-spot in relation to EBP in WPL; unchecked assumptions were perhaps made about what students learn during their placements. The academics suspected students' research-focused learning was disconnected from their clinical subjects and WPL experiences, with EBP possibly seen as an optional add-on.

6.3. Bachelor of Physiotherapy

The BPT academics felt that although their existing EBP curriculum was reasonably comprehensive, EBP was not taught as explicitly as it could be. It was also felt that some students' and WPL supervisors' concept of evidence was too restrictive: The potential of EBP to enhance healthcare would be greater if evidence was considered more broadly than just published research evidence. It was recognised that, in Years 3 and 4, Steps 1 to 3 were 'assumed knowledge' and not routinely revisited or reinforced; the focus shifted to Steps 4 and 5. However, these skills were not usually framed as EBP and it was acknowledged that students might not be conducting Steps 1 to 3 as assumed. Particular concerns were raised in relation to students' learning of Step 1 skills. First, BPT academics noted a strong tendency to ask questions about intervention effectiveness; not about outcome measures, diagnostic accuracy, prognostic predictions, patient lived experiences, etc. Second, students were given little guidance in relation to formulating clinical questions, particularly when PICO (population, intervention, comparison, outcome) question structures were inapplicable. Third, questions set by the academics usually called for research evidence rather than other forms of information. In relation to Step 4, the EBP curriculum was seen to need greater emphasis on individual cultural expectations, values, and sensitivities.

6.4. Common themes

The three teaching teams identified that their conceptualisations of EBP varied. Most steps of EBP were addressed in the respective curricula, but often not explicitly and holistically. Steps 1 to 5 were rarely addressed as a full process in relation to a particular clinical scenario. Instead, EBP skills were taught in a piecemeal fashion with the expectation that students would naturally join them together in their professional practice. There was a tendency to focus on Steps 2 and 3, somewhat ignoring the skills involved in Step 1. Finally, it was suspected that EBP knowledge and skills taught within the courses were not necessarily being reinforced or practiced during students' WPL experiences.

7. What improvements were considered practical and worthwhile?

7.1. Bachelor of Nursing

BN academics felt that a standard definition of EBP (incorporating the five steps) should be promoted so that all BN team members can instruct, model, and assess EBP in a consistent and explicit way. It was also agreed that EBP should be introduced in Year 1, explicating all five steps, and that the skills required for each step should be progressively developed in subsequent subjects. It was felt EBP steps should be labelled explicitly 'as they happen', including in theoretical examples, simulation labs, and WPL pre- and post-briefing. There was a perceived need to work more closely with WPL staff, including through improved

guidelines and documentation, to highlight the importance of developing students' EBP skills. The academics believed the overarching aim should be to ensure their students can explain why EBP is important for all nurses – how it relates to lifelong learning, patient-centred practice, and care improvement – and why it should not be seen as the preserve of senior clinicians and those who have a special interest in research.

7.2. Bachelor of Occupational Therapy

The BOT academics felt that existing problem-based and scenario-based learning activities provided untapped opportunities for practicing EBP skills. For example, students could be given opportunities to practice translating their uncertainty into questions; explaining relevant research as if in response to a client asking a question; and describing how they would apply research evidence in a clinical scenario and explaining their reasoning (e.g., considering the context, client needs, their own skills). To assist students, videos could be shown of therapists explicating the reasoning process. To address unhelpful misconceptions about EBP, the academics felt they should frame client-centred practice as *part* of EBP (particularly Steps 1 and 4); not as separate from it. They felt that orientation training for new teaching staff and WPL supervisors should include a standard definition of EBP; the importance of using common terminology when discussing EBP (including the five steps); teaching and assessing all EBP skills directly and explicitly; and, wherever possible, reinforcing EBP principles (client-centred, enquiring, collaborative).

7.3. Bachelor of Physiotherapy

The BPT staff felt that EBP should be introduced more explicitly in Year 1 of the course, with relevant concepts and skills being continually reinforced and extended in subsequent years, using a template approach. It was also suggested that evidence should be defined more broadly than just research evidence. For example, ascertaining and respecting clients' personal priorities and cultural beliefs is as important as acquiring research evidence. In order for EBP to be better signposted for students, upskilling of staff involved in facilitating problem-based learning (PBL) and WPL was considered important: All parties need a common understanding of what EBP means and how to model it. Carefully designed assessment rubrics were also believed to be important for ensuring that staff and students understand what high quality EBP looks like. It was also felt that students should be given more opportunities to practice and receive feedback on their EBP skills in authentic contexts, including Step 1. For example, students should be given feedback on their attempts to structure clinical questions of various kinds during PBL and WPL. In relation to intervention-focused questions, it was noted that students should be taught that lack of evidence does not equate to lack of effectiveness.

7.4. Common themes

In discussing possible actions, there was a common focus on establishing a consistent understanding of EBP. There were calls for EBP to be operationally defined in subject documentation, including for PBL and WPL staff. The need for *explicit* instruction, demonstration, and assessment of EBP skills was a common theme. Academics in all three teams felt it was important to label when students were engaging in EBP and provide feedback on how they might improve their EBP skills. All EBP steps were considered important to teach, including Step 1. There was also agreement that all EBP steps should be introduced in Year 1 and progressively developed throughout each course.

8. Discussion and Conclusion

The PAR process uncovered a range of EBP education strengths and weaknesses in the three courses. Common themes were evident, which are likely to be applicable in other similar undergraduate healthcare courses. All three courses already had strong references to EBP. Another common strength was the interest and good will shown by the teaching teams towards the project. Identified weaknesses included a lack of explicit teaching about the meaning, principles, steps, and importance of EBP, partly owing to a lack of shared understanding of EBP. A relative lack of emphasis on certain EBP steps was also noted; as was a lack of communication with WPL supervisors about how to facilitate EBP, raising concerns about variable EBP-education quality across WPL settings. Opportunities for improvement were identified by academics in each course, across multiple subjects and years.

At the time of writing, the process of consultation, feedback, and refinement of action-plans is still ongoing. However, so far, agreed improvements tend to be aimed at promoting a shared and explicit understanding of EBP across all academics/subjects in each course, including in WPL. Some agreed actions have already been enacted. Further changes will be made to subject outlines and assessment tasks over coming months.

While major common themes arose, slight differences in focus were evident in the three case studies. These differences reflect different baseline strengths and weaknesses, disciplinary peculiarities, and different views of the academics responsible for building and maintaining the respective courses. These differences were respected in the PAR approach adopted in this project. In all three cases, academics generously engaged in the PAR process. The collaboration and knowledge-sharing engendered in this process are benefits associated with formal Communities of Practice (Gehrke & Kezae, 2017).

PAR aims to involve, empower, and improve (Reason & Bradbury, 2006). In our experience, PAR has been a highly constructive approach to EBP curriculum improvement. Clear benefits are already evident, including heightened interest in, and a deeper understanding of, EBP education among the staff in each course team, and a genuine commitment to numerous

identified improvements. We encourage consideration of a PAR approach for addressing similarly complex curriculum challenges, such as improving students' cultural competency, academic literacy, and interprofessional practice. Systematic, respectful, collaborative approaches to curriculum improvement, such as PAR, are time- and effort-intensive, but promise better outcomes than short-cut, tick-box approaches.

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Get your cell-fie

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Abstract

The goal of this project was to enhance the scientific literacy of primary school and Education degree students by Pharmacy learners, using a collaborative work framework and a SERVICE-LEARNING approach, for all of them to accomplish the general and specific learning outcomes related to the subjects involved in this proposal, that is, Biology and General Chemistry from the Degree in Pharmacy and Research and Innovation in Experimental Sciences from the Degree in Education. Assessments of primary school students´ learning outcomes revealed that 93 % of the kids were able to increase their knowledge on human cells and also widened their scientific vocabulary in, at least, three to five technical words. Education students valued extremely positive the fact that they could work with a different profile of students and the feedback they received from them. Pharmacy students became aware of the importance of the teacher role in society and highlighted the difficulty they had to face when they tried to explain chemical and biological concepts to a non-scientific audience and especially to kids.

Keywords: science literacy; SERVICE-LEARNING; experiential learning; cooperative learning.

1. Introduction

In a highly technified society, such as the one we live in nowadays, scientific literacy is essential to help train citizens to reflect and make appropriate decisions on issues related to science, technology (Solbes and Vilches, 1997) and to their own health. For this reason, from the different educational levels and from a pedagogical and informative approach, we must keep in mind the need to promote and encourage it (UNESCO-ICSU, 1999a-b).

Scientific literacy has to be interpreted as the addition of a triple dimension, the cognitive dimension (know science), the procedural dimension (do science) and attitudinal dimension (value science). On the other hand, we have to take into account that this scientific literacy must be for everybody, without excluding anyone, and always associated with the educational principles of comprehensiveness and equity. This premise is also linked to making "science in school" more accessible, interesting and meaningful. Teaching science is an invaluable instrument to awaken curiosity, develop critical thinking and encourage creativity in our students (Sabariego and Manzanares, 2006).

The active transmission of knowledge is considered the most efficient way to train highly qualified professionals. Therefore, the search for methodologies that allow effective learning is fundamental in current teaching practice (Abadía *et al*., 2011).

The use of participatory methods developed in groups (cooperative learning) enhances the integration of the acquired knowledge. On the other hand, if the activities are framed in the so-called "experiential learning", then the learning process becomes meaningful (Palos, 2010). One of these latest approaches is the SERVICE-LEARNING (SL) because the students significantly learn while they take part in activities that are useful for the community. The SL considers experience, reflection, and reciprocity as fundamental pillars to promote social and civic responsibility in the student, besides the acquisition of knowledge and professional skills (Eyler and Giles, 1999).

The main purpose of any University should be to serve society through the creation and transmission of knowledge, as well as the education of people to become expert and honest professionals. In this line, one of Universidad San Jorge´s main institutional functions is contributing to social development from different areas. Therefore, it is committed to fighting against social exclusion by participating in solidary tasks from teaching and research. The impact on the scientific literacy of society through innovative SL projects constitutes a priority task aligned with the mission, vision, and values of Universidad San Jorge.

2. Objective

According to what we mentioned above, the goal of this project was to enhance the scientific literacy of primary school and Education degree students by Pharmacy learners, using a collaborative work framework and a SL approach, for all of them to accomplish the general and specific learning outcomes (LO) related to the subjects involved in this proposal.

3. Participants

All participants live in Zaragoza, Spain. These participants can be divided into two main groups:

a) Three teachers from Pharmacy (Subjects: Biology and General chemistry) and one teacher from Education (Subject: Research and Innovation in Experimental Sciences) degrees from Universidad San Jorge (USJ)

b) Students:

b.1.) Students with scientific background:

Fifty-four students from the 1st year of the Pharmacy degree (Subjects: Biology and General Chemistry) from USJ

b.2.) Students without scientific background:

- University undergraduate level: Fourteen students from Education (Subject: Research and Innovation in Experimental Sciences, 3rd year) from USJ

- Primary school level: Seventy-five students from 3rd year of one public primary school, CEIP Marie Curie.

4. Tasks and methodology

First of all, the teachers of the 3 subjects involved in the project had to design the workshops for their students, based on the general and specific learning outcomes every group of students had to accomplish.

In the following sub-sections and on Table 1, the different tasks and workshops are explained together with their content, students involved and duration.

4.1. Start-up workshop

Task 1: First of all, Pharmacy students on the one hand, and Education students, on the other hand, all of them in groups of four, had separately their first workshop. They all had to answer two key questions with no online, book or teacher help, i) what is a cell? and ii)what are the cells made of?

Task 2: Pharmacy students were later taught -by the teacher- how to extract their cells from their own saliva and observe them under the microcope.

Task 3: To finish this initial workshop every group of future pharmacists and every group of future teachers had to write a report in PADLET format with the answers to the previous questions.

4.2. Cell and Microscope workshop for undergraduates

Task 4: Pharmacy and Education students worked then all together, in mixed groups of four, and the former showed their answers to the key questions to the later. In the same way, Education students shared with the future pharmacists their information.

Both groups of students worked collaboratively to adjust the specialized key answers to be understood by kids or any non-specialized audience but without losing the scientific rigor.

Task 5: In addition to task 4, the future pharmacists led a second one where the Education students learnt how to extract their own cells from saliva and how to use the microscope to observe them.

Task 6: Right after that, Education students had to i) plan a workshop for primary school kids to explain the key answers mentioned before and to teach how to get their own cells from saliva to be observed under the microscope (assessable product 1), and ii) design and create all the educational materials they were to use in this final workshop (assessable product 2). The contents were reviewed by Pharmacy students to check if Education students really understood the concepts. Likewise, Pharmacy students had to record a one-minute video (assessable product 3), explaining the key answers, to be played before the workshop in the primary school to support pre-service teachers´ performance.

In these first workshops (tasks 1 to 6), all their teachers were present but they didn´t interact with the students; they were only assessing their performance.

At the end of task 6, teachers reviwed students´material before using it with the primary school kids and gave a report to their learners.

4.3. Cell-fie workshop

Tasks 7: When the didactic materials were prepared, all the undergraduate students and their teachers went to the primary school to implement the workshop with the 8-year-old kids. This time, the Education students supported the Pharmacy students with explanations for kids and Pharmacy students supported their colleagues in case they needed some help with technical specifications.

The workshop finished with a picture of every kid´s cells (cell-fie) that teachers glued onto a card, what we called the "scientist card" (figure 1).

Due to the elevated number of primary school kids, task 7 had to be done in three different sessions of 45 min each to guarantee the quality of the workshop.

Once again, the teachers didn´t interact with the students to be able to carry out a second assessment of their performance.

Figure 1. Scientific card with the cell-fie given to the primary school kids

5. Learning outcomes to achieve and their assessment

Through this project all undergraduate students worked on the achievement of the following general learning outcomes:

- LO-1: Applying creativity and innovation in their decisions
- LO-2: Managing conflict with respect and empathy
- LO-3: Explaining complex/technical/specialized concepts into easier/more common ones
- LO-4: Communicating concepts efficiently

These learning outcomes were assessed through rubrics the students knew beforehand. Every student was evaluated by her/himself, by their collegues and by the teachers. This evaluation took place twice, after task 6 and after task 7.

The specific learning outcome for Pharmacy students was:

- LO-5: Applying the knowledge about intermolecular forces on cell biology topics

This learning outcome was evaluated through an opened-ended question which answer had to be developed by the students. This assessment was done at the end of the project.

The specific learning outcome for Education students was:

- LO-6: Designing teaching and learning projects in collaboration with other colleagues from the same or different knowledge areas

Table 1. Tasks, members involved, content and duration for the different workshops of the current project.

Task	Members involved	Content	Duration
1	Pharmacy students Education Students	They had to answer two key questions with no online, book or teacher help, i) what is a cell? and ii)what are the cells made of?	2h
2	Pharmacy Students	They were taught -by the teacher- how to extract their cells from their own saliva and observe them under the microcope	1h
3	Pharmacy students Education students	Every group of future pharmacists and every group of future teachers had to write a report in PADLET format with the answers	1h
4	Pharmacy students + Education students	Didatic transposition: Both groups of students worked collaboratively to adjust the specialized key answers to be understood by kids or any non-specialized audience but without losing the scientific rigor.	2h
5	Pharmacy students + Education students	Didatic transposition: Pharmacy students teach Education students how to extract their cells from their own saliva and observe them under the microcope	2h
6	Pharmacy students + Education students	Creation of the didactic material for the primary school workshop	4h
7	Pharmacy students + Education students + Primary school students	Cell-fie workshop, where Pharmacy and Education Students teach primary school kids the cell theory and how to extract their cells from their own saliva and observe them under the microcope.	3 x 45 min

To evaluate this learning outcome, teachers used rubrics, also known beforehand by the students, and they assessed the didactic material created in task 6.

The suggested learning outcomes established for kids were:

- LO-7: Enhancing scientific literacy
- LO-8: Encouraging kids to be curious and creative
- LO-9: Identifying the cells as bricks of the human body

In this particular assessment a short questionnaire combaining closed-ended and open-ended questions were used. This evaluation was done right after the final workshop (task 7).

Apart form the learning outcomes assessment, a satisfaction survey was used to identify the strengths and weaknesses of the project. This satisfaction survey was filled in by Pharmacy, Education and primary school students (an adapted and easier version for these last ones). This survey had closed-ended questions and a final opened-ended question for the students to give their opinion and reasons why they liked or did not like the project.

6. Results and conclusions

Assessments of primary school students´ learning outcomes (LO-7 to LO-9) revealed that 93 % of the kids were able to increase their knowledge on human cells and to explain, on their own words, what cells were and what they were made of. They also widened their scientific vocabulary in, at least, three to five technical words such as a microscope, cell, lens, etc. At the end of the workshop, around 97 % of kids wanted to be scientists in the future.

Education students´evaluations were very satisfactory, being average marks on assessable LO-1 to LO-4 and LO-6 around 8.7-9.2 out of 10.0. They valued extremely positive the fact that they could work with a different profile of students and the feedback they received from them. They were also very satisfied with the practical experience with a microscope, which found enormously useful for their training.

On the other hand, Pharmacy students obtained average marks on assessable LO-1 to LO-4 and LO-5 ranging from 8.0-9.0 out of 10.0. After these workshops, they became aware of the importance of the teacher role in society. They also highlighted the difficulty they had to face when they tried to explain chemical and biological concepts to a non-scientific audience and especially to kids and how useful the support from the pre-service teachers was.

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Effects of Plagiarism in Introductory Programming Courses on the Learning Outcomes

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Abstract

We compare two introductory programming courses and the accompanying programming assignments with respect to the learning outcomes and the relation to plagiarism. While in the first course the solutions from the students of their programming assignments are checked directly with a plagiarism detection system to prevent students from plagiarizing, plagiarism is not tracked in the second course. Running a post check against plagiarism after the course reveals a significant higher plagiarism rate with several exact copies. As the number of students handing in copies from fellow students increases, the failure rate in the final examination also rises. Analyzing the data does not only reveal a correlation between plagiarizing and inferior examination results, but also shows, that students confronted with a plagiarism detection system have better skills in fundamental coding concepts. We suppose this might be a result of the fact, that the implementation of a plagiarism detection system does not deter so many students from plagiarizing, but students are strongly motivated to run more modifications on their plagiarisms in order not to be caught.

Keywords: Plagiarism; Source code plagiarism; Teaching programming; Automated assessment systems.

1. Introduction

Many undergraduate students in engineering degree programmes have difficulties with learning programming. The curriculum usually involves practical exercises and/ or programming assignments in order to train programming skills, as learning programming requires a significant personal engagement to understand and learn to apply fundamental programming concepts. A student evaluation for such courses typically reflects the high workload required for the practical work. Unfortunaltely, a common approach to lower the effort is to use or adapt solutions of fellow students. Universities implement source code plagiarism detection systems in order to detect and prevent such frauds, compare e.g. Modiba et al. (2016). We were running such a system for 5 years and made experience of many positive aspects, but also found some draw backs, especially with respect to the social behavior of the students as described by Pawelczak (2018). In order to further investigate the effects of plagiarism, we disabled the plagiarism detection system in 2018 and compared the learning outcomes of the course (hereinafter called class B) with the previous year (refered to as class A). We communicated to the students of class B, that plagiarizing would not be tracked during the course. We also made clear, that our experience showed, that plagiarizing has a negative effect on passing the course. Nevertheless, we expected a higher plagiarism rate and also a weaker performance in the course examination. Running the plagiarism detection system after the completion of the course by comparing all solutions of the students with each other, revealed a significantly higher plagiarism rate. Furthermore, the failure rate in the examination rose by 17 %, which supports our assumption, that plagiarizing has a negative effect on the learning outcomes. During the course and while analyzing the performance of the individual students, we found other interesting details, which are discussed in the following chapters.

2. Related Work

We define source code plagiarism as discussed by Cosma and Joy (2008) as reproduction/ copying source-code either without making any adaptions or just providing moderate alternations. Students violate the academic integrity by pretending to be the author of another one's work. Especially in programming courses this is a wide spread phenomenom, as it is very easy to copy a working solution. According to Fraser (2014) reasons for cheating are the lack of interest in the task, insufficient skills or time pressure. Some students also think, that working on the task has no benefit for them. Additionally, as students often work in groups, they do not see a violation, if they all hand in the same solution. As Joy et al. (2013) describe in their study on the students perspective on source code plagiarism, that universities usually implement plagiarism detection systems to deter students from plagiarizing. However, there is often a different understanding of what plagiarism means, e.g., if the lecturer provides code snippets in the lecture – are students

allowed to re-use them in their programming assignments? Students also learn, that re-using code is a paradigm of object oriented programming. Why should their programming work at the university differ from the real world? Two comprehensive studies from Joy et al. (2013) and Simon et al. (2018) emphasize the need for the lecturer to spend more time on educational work with respect to plagiarism and to use a transparent policy when pursuing plagiarism.

Palazzo et al. (2010) showed the correlation between plagiarizing and the learning outcomes in physics education. Altough some students cheat, because they already accomplished the required skills, for the average students, cheating results in less effort spent on the course subject and typically in poorer examination performance. Their study confirms our experience, that it is not sufficient to inform students of the negative effects of cheating, as this will not reduce it. Therefore, a proper stategy to handle plagiarizing is required in order to reduce plagiarizing.

As Bradley (2016) states, source codes in introductory courses provide a high natural similarity, as students are taught to code with a particular coding standard, or as students might be required to use the same names for functions and variables for an automatic grading systems, or because of the use of code snippets from the text book. Bradley suggests to use a randomization of tasks in order to increase the differences among the students's solutions. For our course, we use the tool PlagC2 for the plagiarism detection, which allows common code snippets to be removed. Due to the fact, that most submissions have only around 140 lines of code the natural similarity is typically between 60 and 80 %. Common parts with respect to the programming assignments are taken out before the comparison, e.g. given function prototypes or example code snippets shown in the lecture are removed in order to focus on the students' independent work.

3. Data and Methodology

The introductory C-programming course for first year engineering students requires students to submit seven programming assignments in digital form, and to pass the final written examination.

3.1. Data

The data for the analysis comes on the one hand from the submitted programming assignments of the last two years and on the other hand from the examinations and the students' evaluation of the course. 50 students attended class A and 51 class B. In each course, student feedback is requested. For both classes, the response rate was about 64 %. To analyse plagiarizing among students, about 350 source texts per course are available. We can also access the submission statistics of the automated assessment system, which tracks information on all submissions, e.g. time stamps, incomplete or erroneous submissions as well as detected plagiarism.

3.2. Plagiarism detection

Each source code a student submits, is stored in a database. During submissions, the *PlagC2* tool calculates the similarity of that source code with the sources in the database and returns the highest similarity together with the ID of the matching source code, compare Pawelczak (2018). The automated assignment system rejects submissions in case the similarity exceeds a given threshold. The students are allowed to re-submit another version, although the number of re-submissions is restricted. The threshold varys as the natural similarities are typically different depending on the programming assignment. The threshold is set sufficiently high in order to prevent false positives. In case the similarity exceeds the threshold, we blame the submitting student for plagiarizing.

For class A the submitted source codes were directly analysed by the plagiarism detection system during the submission. Although the system is not able to distinguish between author and plagiarist, as the detection relies on the time of submission, it is very easy for the course instructors to find out, who plagiarized: asking questions on implementation details reveals very easily the cheater. In class B the submissions were only checked against functional correctness without plagiarism detection. For the analysis, we simulated the automated assessment system and fed the system with the submitted source codes from the students in random order and tracked the similarity using the same thresholds.
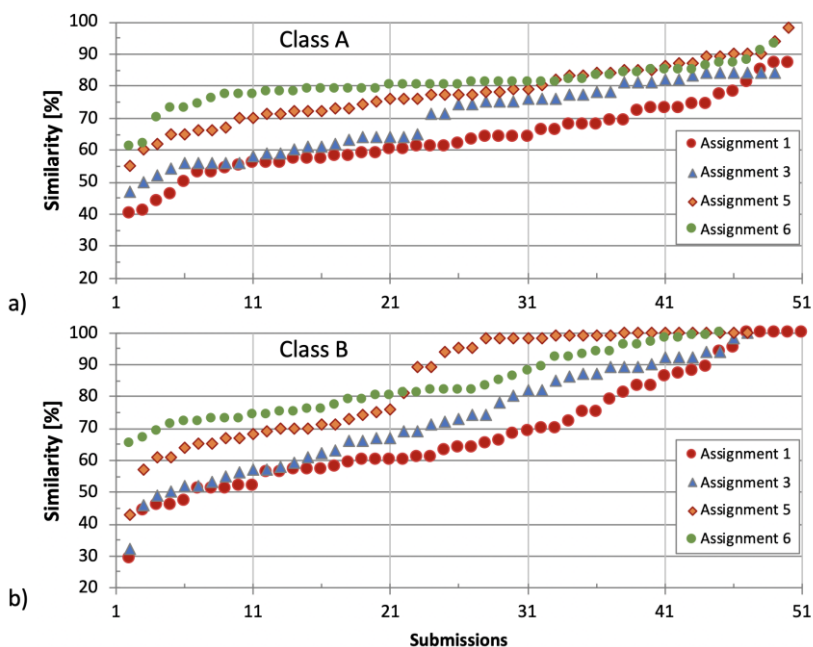
Figure 1. Source codes similarity for the programming assignments of class A(a) and class B(b)

4. Results and Discussion

4.1. Code Similarity and Plagiarism

Fig. 1 shows the calculated maximum similarity of each submitted source code exemplary for the programming assignments 1, 3, 5 and 6 for class A and B, respectively. For a better readability, not all assignments are printed in the diagrams and the similarity is listed in ascending order (not in the order of submission). As the data from class A already passed the plagiarism checks, despite some minor exceptions, the similarities are below the threshold. Table 1 shows the applied threshold and reveals the percentage of sources accused of plagiarism for both classes. As the effort increases with the later programming assignments, the percentage of plagiarizing increases in both classes. The average percentage of students plagiarizing in class A is 11.1 %, while it is 24 % higher in class B: on average 35.1 % of the students were caught plagiarizing with a maximum of more than 50 % in the assignments 5 and 6. On average class B provided 3.7 exact copies per assignment with a maximum of 10 in assignment 5.

Table 1. Results of the plagiarism detection analysis of the programming assignments

Assignments	Integer	Floating Point	Strings	Structures	Arrays	Lists	Files	Average
	1	2	3	4	5	6	7	
Threshold	84 %	88 %	84 %	83 %	82 %	81 %	88 %	84.3 %
Average number of source lines	107	125	162	133	166	172	157	146
Average similarity in class A	64 %	76 %	69 %	75 %	78 %	80 %	80 %	74.7 %
Average similarity in class B	68 %	79 %	72 %	77 %	84 %	83 %	83 %	78.0 %
Percentage of students suspected of plagiarizing in class A	4 %	2 %	8 %	22 %	18 %	16 %	8 %	11.1 %
Detected submissions above threshold in class B	21 %	20 %	31 %	35 %	51 %	53 %	35 %	35.1 %
Unmodified 1:1 submissions in class B	4	3	1	2	10	2	4	3.7

4.2. Examination Results

There are many different influences on the examination results, which makes it difficult to directly compare the results of two courses. Therefore, we also compared the examination outcome of all other subjects for both classes and found on average a difference below 2 %. For instance, class A performed slightly better in *math* and *electrical science*, while class B performed slightly better in *computer science introduction*. From the overall performance of class B, we would have expected similar examiniation results compared to class A. Fig. 2 shows the examination results of both classes and reveals the distinct higher failure rate of class B. Although the plagiarism detection system can not distinguish between author and plagiarist, as discussed in Section 3.2, the students in class A, that were caught plagiarizing reached on average only 47 % in their exams and 8 from 17 students failed. One student in that group had an excellent exam. Although the sources were randomly submitted for class B, the system identified 34 students plagiarizing with 24 out of them failed the examination (with an average of 43 %). Many students among these 24 students were caught plagiarizing multiple times. The system detected a total of 111 sources in class B with the similarity above the threshold.
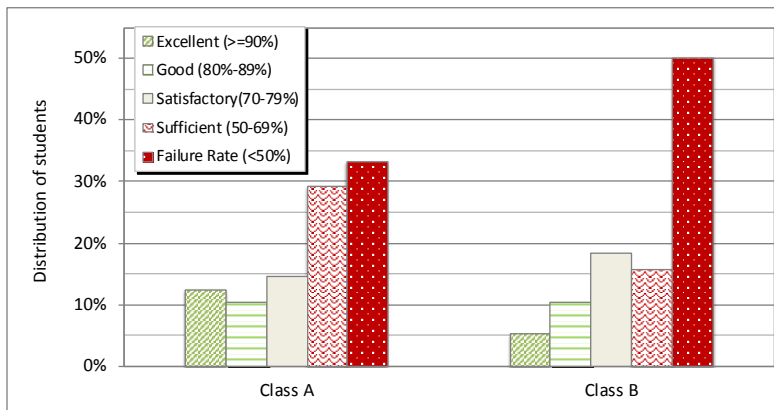
Figure 2. Distribution of students according to the examination results of class A & B.

Looking closer at the key competences students acquired in the examination, it was obvious, that students of class A had better skills in coding common programming constructs, like loops or functions and knew better how to use the standard library functions. We assume, that students do not plagiarize less, when the plagiarism detection system is active, but students have to take care, not to be caught. As the system detects lexical changes, students have to re-write the source code, they obtained from their fellow students. This improves coding skills. With respect to other programming skills like problem solving, we did not find remarkable differences in both classes.

4.3. Examination Results in Other Subjects in that Semester

We found an interesting aspect, when comparing the examination results of both classes in the corresponding semester: class A performed less compared to class B in *physics* and *measurement technology*. In the fourth course *electronic components* in that semester, class A performed slightly better. In average, class B performed 2.5 % better in the examinations concurrent to the programming course. If we take the programming course into account, class B performed 0.7 % worse. Although these tiny swings might be random, it might point to the fact, that course B had more time to prepare the other examinations as plagiarizing is less time consuming, compare Section 4.4.

4.4. Course Evaluation

Class A stated in the course evaluation with 228 hours a higher workload in average compared to class B with a workload of 195 hours. Fig. 3 shows an excerpt from the evaluation results. We asked, which means students found helpful to solve their programming assignments. There was less discussion among the students in class A: 63 % agreed, that discussion was helpful, while in class B 80 % agreed on that (Fig. 3, Question 1). We noticed, that some students in class A were not willing to share their ideas, because they feared, that they might be accused of plagiarizing. While 28 % of class A disagreed, that using code snippets or solutions from other students was helpful, in class B only 15 % disagreed with that. In class B a direct usage of these solutions was possible (Fig. 3, Question 2).
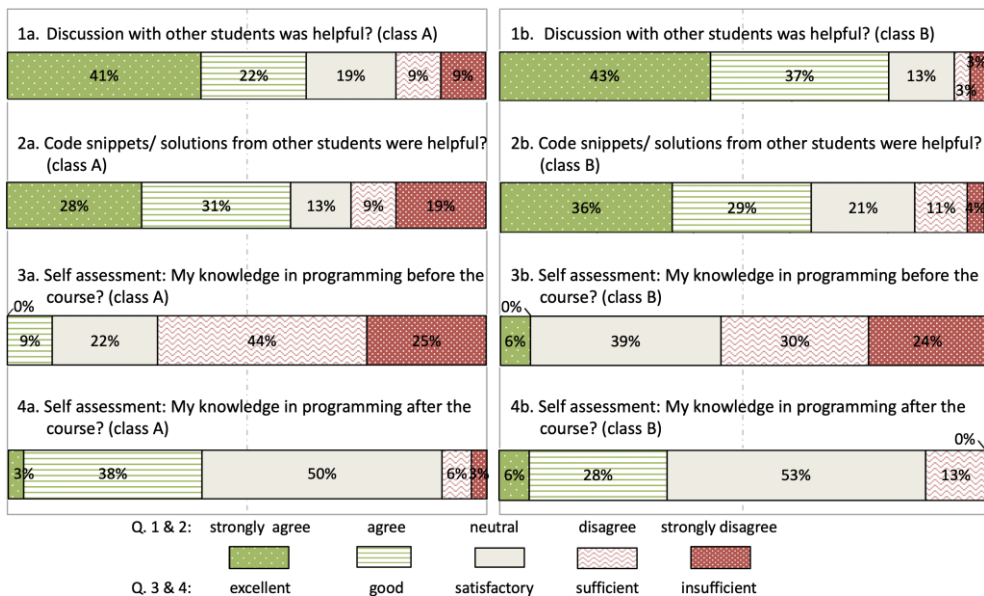
Figure 3. Excerpt from the students' evaluation of class A & class B.

Interesting is the comparison on the self-assessment of the students (Fig. 3, Questions 3 and 4). We ask about their knowledge of programming before and after the course. In both classes the majority judged their knowledge before the course as below satisfactory, more than 80 % felt their knowledge satisfactory, good and excellent after the course. In class A, a much higher development can be seen: In class A some students increased their assessment over 3 grades, i.e. from insufficient to good or sufficient to excellent, while in class B the difference was two grades maximum.

5. Conclusion and Outlook

The use of a plagiarism detection system does not prevent students from plagarizing. It has a deterrent effect on some students, and as we observed, sometimes even a disquieting one. It also challenges smart students to outwit the system. A large group of students will still use solutions from other students, but they have to spend time on modifying the solutions in order not to be caught plagiarizing. The last aspect especially has an effect on the learning outcomes. Students faced with the plagiarism detection system showed a better knowledge of fundamental coding skills like writing loops, making code more modular (e.g. by outsourcing code into functions), or finding alternative solutions (e.g. by using different API functions).

Plagiarism detection systems do not surpress open discussions and collaborations among students as the course evaluation revealed, but an effect of exclusion and reluctance is observable. As Fraser (2014) concludes, we need to establish a learner's friendly environment, which allows collaboration. We still need means to deter students from plagiarizing and to help them to invest more in their own work. We definitely will apply the plagiarism detection system in the upcoming course, but we also want to reduce the effort of the assignments 5 & 6 by adding more voluntary tasks, to see if this results in less students copying their solutions.

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Preparing for anatomy assessment with adaptive learning resources – It is going "tibia" okay!

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Abstract

Anatomy subjects are content heavy and generally have a high stakes practical examination that is difficult to prepare for outside of the laboratory. With recent advances in technology, increased class sizes and reductions in teaching time, alternative and novel teaching technologies are emerging. An adaptive online simulated practical examination was developed. This lesson was evaluated using a survey, student interviews and learning analytics. Of the 55 students who completed the survey, 92% indicated that the simulated practical examination enhanced their learning. Ninety two percent of students reported that the lesson met their needs for flexibility and importantly, our study also confirmed that there was a positive relationship between performance in the simulated practical exam and both the actual practical examination and overall subject score. Findings from this study revealed that adaptive learning technologies show significant promise and are an effective, flexible tool for preparing students for practical exams in a challenging subject.

Keywords: Adaptive learning; Smart Sparrow; Allied health; Anatomy; Assessment.

1. Introduction

An understanding of human anatomy is essential for undergraduate allied health students. Anatomy subjects are generally taught in the first two years of undergraduate allied health courses and even for students with prior knowledge in biological science, these subjects are daunting and difficult. This is because success is dependent on spending considerable time examining cadaver specimens in the laboratory to be able to recall anatomical structures which is then assessed in an end of semester practical exam. Current limitations on how much time students can spend revising anatomy in the laboratory, increased class sizes, staffing constraints and increasing costs of cadaver-based instruction, have led to developments in online technologies. Computer based learning resources have become commonplace in the anatomy curriculum (Green et al., 2018) as evidence suggests that student success is maximised when a combination of pedagogical strategies are employed (Estai & Bunt, 2016). Indeed, there are reports of improvements in student learning and outcomes when traditional methods are replaced with student centered learning and more interactive teaching (Biggs & Tang, 2011; Zwick, 2018). Modern adaptive learning experiences that are designed for high engagement, yet are flexible to the needs of learners present a unique way to address challenges in teaching large, practical based anatomy subjects.

Adaptive learning personalises the student experience by adjusting the level of instruction or feedback in response to individual responses (Oxman & Wong, 2014). It also provides a flexible learning environment where modern day students who are often time poor can control where and how they learn in an efficient manner. Adaptive learning therefore has the potential to provide genuine individualised, flexible and engaging instruction and offers a novel way to address the perceived difficulty associated with anatomy and at the same time prepare students for anatomy assessment outside of class time. One example of an adaptive learning platform is Smart Sparrow. While recent literature supports the use of Smart Sparrow across a broad range of undergraduate disciplines (Makransky et al., 2016; Polly et al., 2014; Velan, 2015; Wong, 2015), there are currently no studies specifically evaluating the use of adaptive learning technologies for teaching anatomy to allied health students and in particular how these technologies can be used to prepare students for practical assessment.

The overall aim of this study was to analyse student feedback and examination performance following completion of an online adaptive simulated practical examination. We specifically examined whether;

1. Completion of the lesson enhanced student learning in anatomy
2. Completion of the lesson provided a flexible and time efficient way of preparing for the end of session practical examination.
3. There was a relationship between performance in the simulated practical examination, the actual practical examinaiton and the overall subject score.

2. Methods

The participants were 55 allied health students enrolled in first and second year anatomy subjects in 2018. The students were enrolled in the Bachelor of Podiatric Medicine, Bachelor of Occupational Therapy, Bachelor of Physiotherapy or the Bachelor of Health and Rehabilitation Science. Ethics approval for this study was received from The Charles Sturt University Human Research Ethics Committee (HREC Protocol No: 2015/265).

The Adaptive Learning platform developed by Smart Sparrow (http://smartsparrow.com) was used to create the novel adaptive simulated practical examination. A variety of high resolution photographs of cadaver specimens and anatomical models that students would be assessed on in the actual practical examination were incorporated into the lesson so that students could practice answering exam questions in an environment that was as authentic and as similar as possible to the practical exam environment (Figure 1). Adaptive feedback was built into the lesson and provided to students based on their individual responses.
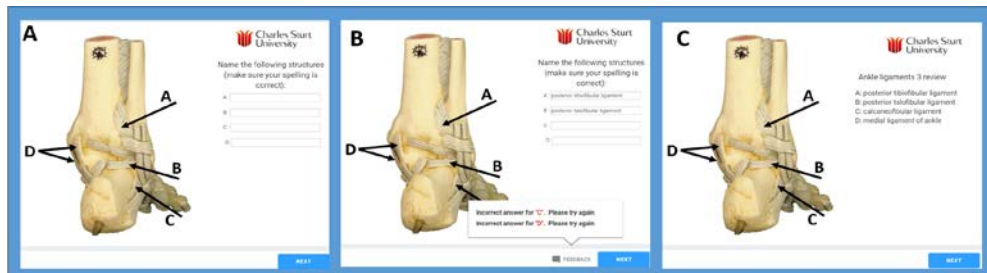
Figure 1: Screenshot of the adaptive simulated practical exam. Model with structures A-D that require labelling (A). Feedback provided for two incorrect answers (B). Answers for all four structures displayed (C).

Students evaluated the adaptive simulated practical examination on their learning and preparation for the end of session practical examination by consenting to completing an online survey (n=55), making Smart Sparrow learning analytics and subject Blackboard analytics available (n=41) and/or participating in an interview (n=2). A structured online survey contained 6 questions measured on a 6-point Likert scale to assess the level of (i) learning from the lesson and (ii) flexibility of the lesson. In addition, students were also asked to rate their understanding of the content before and after the lesson. There were also 2 open-ended questions related to what the students liked most about the lesson, and what changes they would like to see to further improve the lesson. Group means were compared using a paired t-test and were analysed using the stastistical package GraphPad Prism (Version 8.0). The significance level was set at $p < 0.05$. For the subset of students that consented to Smart Sparrow and Blackboard data analysis, correlations between the Smart Sparrow simulated practical exam scores and overall subject score were analysed with a Pearson correlation coefficient using GraphPad Prism (Version 8.0). Significance level was set at $p < 0.05$.

3. Findings

Overall, results from the online survey in combination with analytics revealed that the adaptive lesson facilitated learning and allowed students to prepare for the actual practical examination in a time efficient manner. In the small subset of students that agreed to the analysis of subject Blackboard data there was a positive correlation between the simulated practical test score, the actual practical test score and overall subject performance.

3.1. Learning

Students reported that the simulated practical examination (i) improved their learning (ii) helped to identify priorities for learning and (iii) lesson feedback enhanced their learning (Table 1). Comments from open ended questions and interviews indicated that students liked that the lesson "tested my current knowledge" and that it was in a test environment "I know you never know anything until you test yourself". Other comments relating to learning included "It did help me immensely, in my prac exam" and "My grade would have suffered I am sure, because I would have spent a lot of time trying to orientate myself with the specimen, rather than having seen it on the Smart Sparrow".

Table 1: Percentage of students that "very strongly agreed" or "strongly agreed" with statements (on a 6-point Likert Scale) relating to learning and flexibility of the simulated practical examination.

Learning	% Agreement
It improved my understanding of the topic	89%
It helped me to identify priorities for my learning	92%
It provided feedback that enhanced my learning	83%
Flexibility	
It made my learning more efficient (saved time)	89%
It met my needs for flexibility in my learning	92%
It provided an individualized learning environment	88%

Thirty eight students answered the question to "rate your understanding of the lesson on a scale of 1 to 10 before you used this lesson" and to "rate your understanding of the lesson on a scale of 1 to 10 after you used this lesson". Thirty two (84%) of these students indicated that they had a better understanding of the content after completion of the lesson (5.4 vs 7.8, $p < 0.0001$; Figure 2).
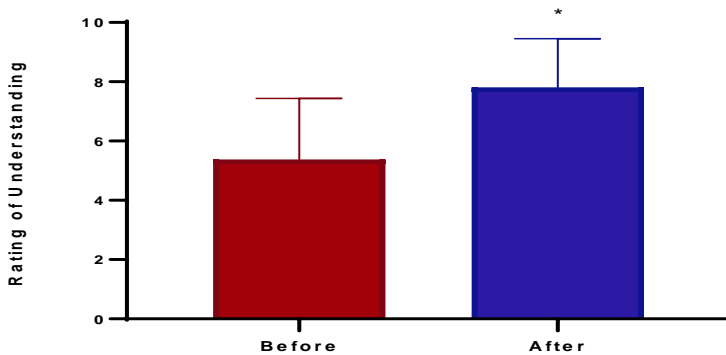
*Figure 2: Improvements in students' self-reported understanding of the subject content before and after completing the simulated practical examination *p<0.0001.*

3.2. Flexibility and preparedness for assessed practical exam

Students overwhelmingly reported that the simulated practical exam made learning more efficient by saving them time, met their needs for flexibility in learning and provided an individualised learning environment (Table 1).

Student feedback from the open-ended questions in the online survey and from the interviews also confirmed that the simulated practical exam provided a flexible learning environment: "It provided the framework to test yourself repeatedly" (Survey feedback) and "I wish we had these opportunities in all of our subjects" (Student interview)

A positive correlation between student performance in the simulated practice examination and performance in both the end of session practical exam ($r = 0.6$; $p = <0.0001$), and overall subject performance ($r = 0.43$; $p = 0.006$; Figure 3) also provided evidence that the adaptive lesson prepared students for assessment items.
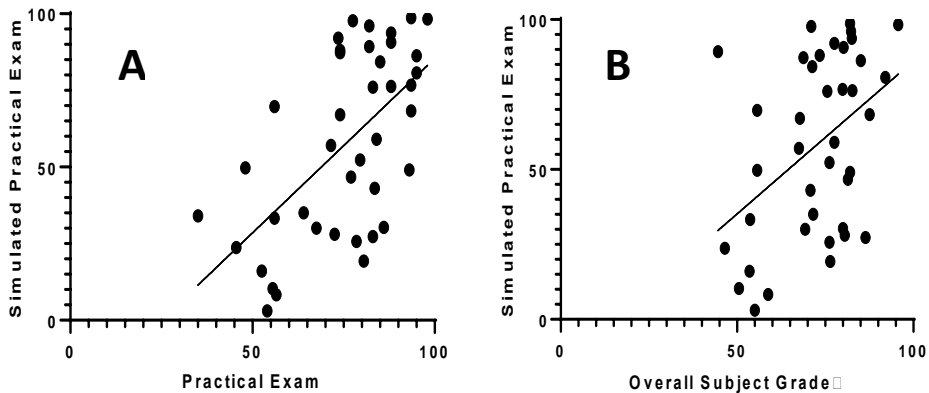
Figure 3:Correlation between performance in the simulated practical exam and the practical exam (A) and the overall subject grade.(B)

4. Discussion and Conclusion

Overall, this study demonstrated that completion of the adaptive lesson enhanced student learning in anatomy, provided a flexible and time efficient way of preparing for the end of session practical exam and showed that there was a relationship between performance in the simulated practical exam, the actual practical exam and the overall subject score. Our finding that the adaptive lesson enhanced student learning anatomy is consistent with other studies that have examined learning with adaptive learning resources versus conventional teaching methods (Wong, 2015; Samulski et al., 2016)

One of the most powerful findings from this study was that the simulated practical exam assisted students in preparing for the assessed practical exam by identifying gaps in their knowledge. At the same time students found the adaptive lesson to be a time efficient way of studying. So for many modern day students who often have minimal time for study, this resource is a fantastic asset - not only do students have a way of finding out what they don't know but they also have a flexible resource that they can access anytime and anywhere to consolidate that knowledge (Collis et al., 1997). These adaptive resources are not only invaluable in anatomy subjects as we have shown here but there is enormous potential for them to be applied to many different disciplines to assist students in assessment preparation particularly when students often have four end of session assessment items due at roughly the same time (Makransky et al., 2016; Green, 2018; Wong et al., 2015). Indeed, this was evident from the student interviews where there was a clear message from students wishing that the resources were available in all subjects.

The study also demonstrated that there was a correlation between performance in the simulated practical exam and both the end of session practical exam and overall subject grade. While this was pleasing it would have been ideal to compare practical exam scores and overall subject grades between students that had completed the simulated practical examination with those that had not. This was not possible as the latter group did not give consent to access their subject analytics but future studies will aim to quantify the relationship between learning with the adaptive resource and subject success.

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Online Continuing Professional Development: An integrative approach

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Abstract

This paper reports on the design, development, delivery and evaluation of an online continuing professional development (CPD) course in the area of online teaching by three Irish Higher Education Institutes (HEIs). The course was developed in the context of a nationally coordinated effort to promote CPD of those that teach in Higher Education through digital badges. Survey results suggest a very high overall satisfaction rate with the course as a whole, increased levels of knowledge and confidence in relation to teaching online, and also intended transference to practice. While the external motivator of demonstrating engagement through the digital badge arose in the surveys and focus groups, it did not feature particularly strongly. Implications for CPD are discussed in relation to internal and external drivers and motivations around CPD for higher education teachers, and the need for opportunities for participants to interact and engage in the manner reminiscent of a community of practice approach.

Keywords: continuing professional development (CPD); digital badges; online teaching; higher education.

1. Introduction

The use of digital technologies continues to expand within higher education globally. With this growing use comes a need for teaching staff to be supported and encouraged in their use of these technologies to create innovative and effective learning. This paper reports on the design, development, implementation and evaluation of an open course aimed at those getting started with online teaching, which was delivered by distance by three Irish Higher Education Institutes (HEIs): Hibernia College, University of Limerick, and Cork Institute of Technology. The three HEIs received funding from the National Forum for the Enhancement for Teaching and Learning to develop a CPD offering on the topic as part of its National Digital Badge System[1]. The curriculum of the open course covered designing online units and assessments, developing educational content and media, and creating a positive online environment for learning. An iterative, collaborative approach was taken to the design of the learning material and associated media for a fully online delivery through Moodle, Articulate Rise© and additional standard multimedia editing tools.

Underpinning the philosophy of the course, it was recognised that an understanding of the student perspective and what it is like to study online is crucial. A number of videos featuring online students talking about what they like and what they find challenging about online learning were created for the course. The perspectives of some lecturers and tutors who have been involved in online teaching were also integrated. Most importantly, best practice of online teaching was modelled through a number of synchronous and asynchronous activites, and in addition to the content there were, notably, extensive online activities and opportunities for online communication and collaboration.

The course was divided into four sections. First, it focuses on designing modules for the online environment. In the second section, some online assessment options are presented and discussed. Next, it focuses on online activities and content creation; in particular looking at open education resources and approaches to media creation. The last section focuses on online facilitation and interaction and includes some strategies for engaging students in the online space and building a learning community.

The eight week online implementation of this open course was a notable success in terms of its popularity, its positive reception and in terms of its mainstream impact across a number

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[1] The National Professional Development Open Courses in Ireland has been developed by the National Forum for the Enhancement of Teaching and Learning in close collaboration with the higher education sector to create a means of recognising and acknowledging those committed to ongoing professional development in teaching and learning. The first phase of the national professional development digital badge initiative in 2017 saw the design of 15 open-access programmes with national digital badges to the HE sector, each covering a relevant topic to academic's professional development, and equaling around 25 hours of participant effort. These open courses have been developed against nationally agreed criteria, thus enabling staff to have achieve recognition and mobility within their professional development journey and career advancement.

of HEIs. As an initiative of the National Digital Badge System the course also allowed successful graduates to claim a specially designed digital badge to recognize their learning.In the context of a growing but fragmentary body of literature on approaches to and models of online academic CPD (see, e.g.,Donnelly, 2015; Kennedy, 2005; King, 2002; Klein & Ware, 2003; Riding, 2001) the current paper presents findings with regard to five key research questions (RQ): (1) what are the motivations underpinning the participation of lecturers in this course?; (2) did this online professional development course increase the knowledge of lecturers about teaching online?; (3) did this online professional development course increase the confidence of lecturers about teaching online?; (4) has this course impacted the attitudes of lecturers to online teaching?; and (5) has this course impacted the teaching practice of lecturers?

2. Methods

A basic mixed methods approach was used to investigate the research questions outlined above. Data gathering methods consisted of a quantitative pre and post-survey, and a number of focus groups. The mixed methods approach represented a deliberate effort at methodological triangulation, in an attempt to examine the experiences, motivations and outcomes of our learners from more than one methodological or epistemological standpoint. All but one of the 37 participants who were offered a place in the course consented to take part in the research and completed the pre-course survey. 26 responded to the post course survey, representing 76% of the 34 participants who completed the course. A total of 10 participants took part in the focus groups on completion of the course. Thematic analysis of qualitative focus group data was undertaken based on guidelines from Braun and Clarke (2006). Participation on the research phase of this course was at all times voluntary and anomymous, and ethical clearance was obtained through Hibernia College, and recognized by the other participating institutions.

3. Results

3.1. Pre and post survey results

The results of the pre-survey revealed high levels of experience of online learning as student (86%), and as a teacher (67%). Digital confidence levels were also high or very high (56%), and most were either already involved to some extent in online or blended delivery or were planning to do so in the near future. When asked what motivated them to participate, the main reasons given were related to a general desire for professional development, enhancing their knowledge of learning design for the online context, learning how to develop content for online delivery and finding out more about engaging students online. Others made reference to planning, assessment delivery and support. Only two people specifically mentioned the

digital badge that was associated with the course. As seen in figure 1 below, participants were positive about the effectiveness online delivery as a mode of teaching and learning. They were also generally positive about the possibilities for engagement, interaction and collaboration.
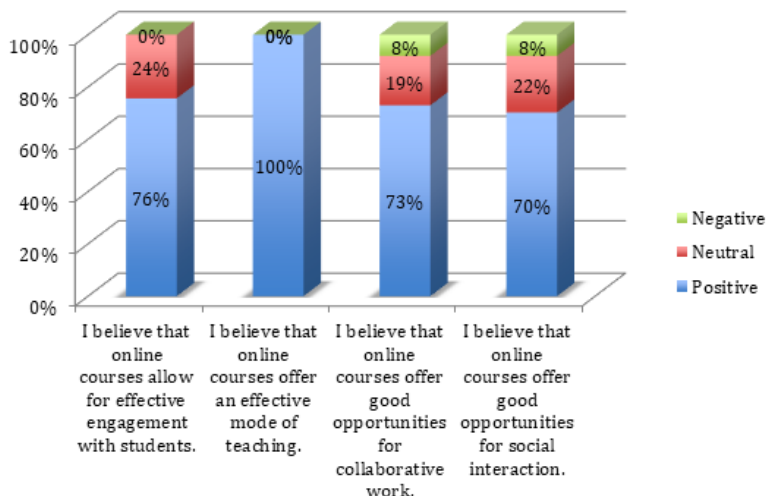
Figure 1. Attitudes to online teaching and learning

Asked about their satisfaction with the course, all 26 respondents of the post-survey were satisfied (42%) or very satisfied (58%). The teaching methodologies used in the course were rated as effective (46%) or very effective (42%). All stated they would implement what they learned in the course, which was in relation to the practice and experience of using various tools, the overall enhanced knowledge of what's involved in online and blended learning, the confidence they gained from participating in the course and the alignment with their more general plans to deliver online/blended courses. In terms of the impact of the course, 80% of respondents claimed the course had changed the way they think about online learning. The results were overwhelmingly positive in relation to the confidence levels in terms of design, content development, assessment and facilitation of online teaching. Out of 26 survey participants, a majority affirmed they were confident or very confident when creating content for online delivery (23), designing a module for online delivery (22) designing assessment for online learning (19) and facilitating a module online (20). Most of the 23 respondents referred to the design and structure of the course as its strongest point. The discussion forum and the focus on tools were next most widely referenced items. By far the most common complaint was 'lack of time', in relation to both the timing of the course and the workload involved. Some respondents also mentioned lack of student-student interaction and specific tasks that the participants didn't enjoy. Enhancements suggested included a detailed calendar at the start of the course, more flexibility regarding the timing of the course, and a greater

focus on encouraging student-student participation. All those who responded to the post-course survey said they would be claiming their digital badge.

3.2. Thematic analysis of focus groups

Braun and Clarke's (2006) approach to thematic analysis of transcribed focus group material has proved helpful as 'an essentialist or realist method, which reports experiences, meanings and the reality of participants'. After identifying five main semantic themes (motivations to participate, engagement with the course, impact on teachers, impact on practice, and other benefits), text was coded hierarchically in two sub-levels. Most of the coded text clusters around motivations to participate (40 references) and impact on teachers (46), with the other themes gathering far less number of references. The analysis of motivations to participate in this course (RQ1), clustered around either extrinsic or intrinsic drives. Extrinsic motivations included (1) demonstrating engagement with CPD and accreditation through the digital badge; and (2) incentives, pressures and relevance to practice, including impending plans for moving courses online. Intrinsic motivators included (1) interest in the development of theoretical knowledge and practice on OT, (2) exposure to and modelling of OT, (3) exposure to new technologies and learning new digital skills, and (4) personal interest and convenience of the course at the time when it took place. Closely related to motivations to participate, a series of themes revolved around the participants' engagement with the course. These included the following: (1) their commitment to and approach to participation (which ranged from the more strategic to those who engaged at a very deep level); (2) challenges to engagement, including a perceived high workload associated with the tasks that the course consisted of; (3) insights around the development of a community of inquiry throughout the course, which was perceived by many to be the most positive and distinctive characteristic of this course; (4) their experiences with the tools or platforms (both positive and negative); and (5) the importance of teaching presence, which was at the core of the community of inquiry. The exploration of the impact that the course had on teachers revolved around how their knowledge, confidence and attitudes of OT had evolved, corresponding to RQ2, 3, and 4 respectively. The most important gains in terms of knowledge consisted of (1) exposure to and modelling of OT, (2) exposure to new technologies and learning new digital skills and (3) theory and practice of OT. New or existing attitudes developed regarding (1) acknowledgement of value of OT, (2) the need for educational and technical support, and (3) an increasing awareness and understanding of the many considerations that OT involves, with special attention to its implications for curriculum design and student and staff workload. Participants also offered their insights around their increased self-confidence as online teachers. In close relation to this, some evidence of impact on practice was gathered (thus answering RQ5), although it was widely acknowledged that these are more likely to be realised in the future. These implications included (1) promoting OT practice in their immediate context with peers and managers and (2) prompting action around OT design. In

doing this, participants often found that the artefacts created during the completion of the course (the design of their online module and associated materials) were useful as exemplars of potential practice, and could be used to demonstrate and influence teaching practice in their context. Also, some other implications were recorded, which were somewhat unexpected. The participation in the course had a positive effect on the development of communication and writing skills, and even prompted some participants to continue CPD around OT. Others appreciated the opportunity to network between institutions and declared their increased awareness of the National Forum resources and initiatives.

4. Discussion and conclusions

Pre-survey responses with regard to motivation and what participants wanted from the course dovetail nicely with a number of post-survey responses and associated follow-up comments as well as with a host of intrinsic and extrinsic motivations that emerge from the analysis of focus group data. Although all participants indicate in the post-survey that they plan to claim the available digital badge, and this also arose during the focus groups, it is notable that the digital badge did not feature particularly strongly. As extrinsic rewards can conflict with or diminish intrinsic motivation (see, e.g., Deci, Koestner, & Ryan, 1999), it seems that a balance was stroke in this occasion. The issue of accreditation arose for the design team itself in a number of ways, due to an emphasis on the award-bearing national standard-setting aspect of the course around closely-defined pre-planned outcomes and, although this was resisted, a tendency towards a technicist syllabus. The project team were keenly aware throughout the design process that external accountability (e.g.,Smyth, 1991) could work against critical and reflective inquiry which we were keen to encourage. The design team were eager also to reject a purely training and/or transmission view of academic CPD and move at least in part towards a transformative approach that left room for unplanned learning outcomes in relation to attitude, values and practice-in-context as well as procedural knowledge and technical know-how. Part of the solution in the end was to build in opportunities for participants to interact and engage through a community of practice (CoP) CPD approach (Wenger, 1999). The *Getting Started* course was deliberately structured to encourage participants to move from quite basic replicative tasks to producing innovative original units of e-learning and critical reflections on same. Thus, participants began with "legitimate peripheral participation" and then moved towards the centre where they created new practice. Wenger's notions around CoP as social learning systems, constructs of meaning and identity chime well with focus group comments as do, of course, numerous references to the related but distinct concept of community of inquiry (Garrison, Anderson, & Archer, 2003).

It seems ultimately that the Getting Started CPD course charted a middle course between a context-free transmission training model offering and an open transformative CPD offering

with no planned outcomes. In any case, the results highlight the importance of professional dialogue for professional development and the importance of providing dialogic opportunities and professional dialogue (Asghar & Pilkington, 2018). Results do suggest CPD providers might do well to consider mixing pedagogical approaches and balancing perscribed learning goals with opportunities for learner autonomy and, most importantly, learner interaction. CPD itself, particularly CPD with external validation or based on external standards, can suggest an instructionalist and also technicist orientation but can accommodate more progressive pedagogies and approaches including coaching, mentoring, CoPs and communities of inquiry as well as learning that does not exclude or try to design out questions of context, value, identity and meaning. Traditional issues arising for CPD around learning transfer, learner engagement, consistency, quality assurance and demonstration of return on investment (ROI) may ultimately only be answered only by taking both a holistic and pragmatic approach based on a thorough knowledge of available technical and pedagogical approaches, the learning domain itself and the needs of the learner group.

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Diversifying Initial Teacher Education: Who Utilises Alternative Entry Routes to Teaching & How They Compare to Direct Entry Students

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Abstract

Recognition of the growing homogeneity of the Irish teaching body (Keane & Heinz, 2016), and increasing awareness of the positive impact a more diverse teaching population have on disadvantaged and diverse students' educational engagement, has precipitated an Irish policy response which has included funding a university foundation course (FC) which supports students who are underrepresented in teaching, to progress into initial teacher education (ITE).

There is a dearth of empirical research on who is accessing these interventions, and how these students differ from those who 'usually' apply to and enter ITE directly. Consequently, in September 2018, twenty FC students and eighteen students from the direct entry group completed an on-line survey in order to compare the demographic make of both groups.

The results of the descriptive analysis indicate that students utilising the ITE FC are more diverse in ethnicity, disability status and academic history, and have greater levels of disadvantage in terms of family history of education and family occupation than those entering ITE directly. These results highlight the value of utilising alternative entry routes to ITE, and their potential to support those disadvantaged and underrepresented to take the initial step into ITE.

Keywords: Teacher Diversity; ITE Foundation Courses; Access to ITE and Higher Education.

1. Introduction

In recent years Ireland has witnessed unprecedented growth in the number of diverse populations living and working across the country (Smyth, Darmody, McGinnity, & Byrne, 2009). This has resulted in increasingly complex and diverse school populations. Education policy has responded by attempting to place inclusive practice, and diversity, front and centre, resulting in the introduction of the Diversity in Teacher Education longitudinal programme of research and the Programme for Access to Higher Education (PATH) – both recognising the need for a teaching profession which reflects the diverse student body. Running alongside the challenges that growing diversity brings, is the broader issue of equity of access to higher education (HE), and high-status professions, for students considered disadvantaged. In this context disadvantaged is defined as those individuals whose personal, family, social, and/or economic circumstances have hindered their ability to participate fully in education. Research shows that despite significant investment in education initiatives, disadvantaged students are five times less likely to gain access to university than their more affluent peers (Hannon, Faas & O'Sullivan, 2018; O'Sullivan, Robson & Winters, 2018) and access to high-status professions is often stratified by social class. Numerous studies also show that social recruitment to high-status professions, such as law, teaching and medicine, is more unequal than for many other career paths (Crawford, Dearden, Micklewright &Vignoles, 2017; Keane & Heinz, 2016) and that a myriad of academic, aspirational and cultural factors often hinder the opportunities of disadvantaged students (O'Sullivan, Bird, Robson & Winters, In press).

One profession that is particularly difficult to access for cultures and classes is teaching. Recent data shows that over 90% of Irish pre-service teachers are white, settled, middle-class, females (Keane & Heinz, 2016). In line with the growing focus on equity of access, Irish policy makers have begun to reflect on the possible negative impact that such a homogenous teaching body can have on the academic and aspirational development of the diverse student body. Policy makers are beginning to examine the impact that teachers who themselves represent diverse cultures, classes and experiences, have on disadvantaged student's education engagement (Burns, 2016; DES 2002; Lynch and Lodge 2004; Moran 2008; Teaching Council 2008, 2011; Conway, Amel & Gerwien, 2009; Heinz, 2011) AND on their aspirations to move into the teaching profession. Research is also beginning to focus on the specific challenges facing disadvantaged students when accessing high-status professions like teaching, and there has been growth in the number and type of interventions which aim to support disadvantaged and diverse students to progress into the teaching profession across the Irish HE sector.

In 2017 Maynooth University, Ireland, launched the *Turn to Teaching Project*; a unique three-year programme that aims to support 100 students from educationally disadvantaged backgrounds to move into Initial Teacher Education (ITE). The programme, funded through the Higher Education Authority (HEA) and Maynooth University, aims to address the

academic, social and personal challenges faced by underrepresented groups within the teaching profession and offers a meaningful pathways into ITE for students from the Irish Traveller community, migrants, mature students, and students coming from schools listed under the Department of Education's Delivering Equality of Opportunity in Schools (DEIS) programme. It offers a one-year, pre-university, foundation course (FC) entitled '*Think about Teaching'*. Historically FCs have been used as a way of supporting targeted groups to transition into university study (O'Sullivan, Byrne, Robson & Winters, 2019). These are intended for those without the formal entry qualifications for their chosen degree and are designed to prepare students for degree level study (O'Sullivan et al., 2018). In Ireland, they have traditionally been delivered in the university context, and they generally target underrepresented student groups. For the socioeconomically disadvantaged learner and/or the mature learner, the supports offered are designed to facilitate the development of social and cultural capital alongside academic skills and subject specific content. They recognize that the challenges facing such groups are complex; supporting peer relationships, academic growth and confidence, preventing students feeling under qualified compared to their peers, and aiming to provide them with access to bridging capital that support transitions and retention within HE (O'Sullivan et al., 2018). A review of these programmes in Ireland demonstrated the effectiveness of the model in supporting students to progress into HE (Murphy, 2009) and evidence found that retention and graduation statistics were in line with those of direct entry students (Share & Carrol, 2013) even in courses considered 'elite' or 'hard to access' including medicine and law. Maynooth University's '*Think About Teaching'* FC is the first programme which aims to prepare students for teaching training, offering a unique opportunity to examine the type of students who access ITE through alternative entry routes.

Theoretical advancement in this area has focused on understanding the barriers facing disadvantaged students when considering high-status professions. Aspiration focused discourse places the onus on the individual, explaining differential rates of participation on the basis of attitudinal factors, implying that non-participation is due to lack of personal expectation (Bruce & Bridgeland, 2014). Others assert that academic achievement is the primary barrier to participation (Chowdry, Crawford, Dearden, Goodman, & Vignoles; 2013; Jones & Thomas, 2005). With large disparities seen between the educational attainment of disadvantaged students and their more affluent counterparts (Coley, 2002; Burgess, Ding, Hargreaves, Van Ryn & Phelan, 2008; Feinstein, 2003; McKnight, 2015) this approach frames access to high-status professions in terms of human capital; seeing the barriers in terms of an individual skill deficit (Hannon et al., 2017; Thomas, Yorke & Woodrow, 2003). Both approaches emphasize barriers which exist within the individual, and indicate impoverished levels of personal agency, including reduced freedom to decide and reduced power to act and be effective (Crocker & Robeyns, 2009; Wilson-Strydom, 2012, 2016). More complex explanations see 'choice' as a result of the interaction between structural and

individual characteristics. Disadvantaged students often lack experience of an educational structure which is designed and dominated by the ruling classes, which makes progression, retention and belonging in HE difficult (Reay, 2005; Reay, Crozier, and Clayton, 2009; Reay et al., 2008; HEFCE, 2015). When the structural issues are combined with the individual attitudinal and aspirational deficits, disadvantaged students face significant difficulties when attempting to navigate HE (Chowdry et al., 2013; McKendry, Wright, & Stevenson., 2014; Loveday, 2015) and high-status professions like teaching (Griffin, & Hu, 2015; Wilkins, & Burke, 2015). Furthermore, while these barriers are well defined and described, little is known about the people who actually succeed despite facing these barriers, or about those who choose to take what can be considered the 'road least travelled' in the educational and employment context.

In Ireland policy responses to the homogenous nature of the teaching body have included funding the provision of a university run foundation course which supports students who are considered disadvantaged, and underrepresented in teaching, to progress into ITE degree programmes. Yet, despite the voluminous literature pertaining to widening participation issues there is a dearth of empirical research that seeks to understand who is utilising these interventions, and how these students differ from those who 'usually' apply to and enter ITE directly. Thus, the current study seeks to add to the current body of knowledge by establishing the demographic make-up of the student group participating in the first year of the *Think about Teaching* FC; it aims to establish the family and personal characteristics of these students and to compare these with students who enter ITE directly in the same university. Hence the research asks the questions; who utilises alternative entry routes to teaching degrees and how do they differ from those who enter ITE directly.

2. Methodology

A survey design was employed. In September of 2018 an online survey was sent to all 23 students who had been accepted onto *Think about Teaching* FC for ITE. Students in the primary teaching degree programme in the university were also invited to complete the survey, through the student social media page. Twenty FC students completed the questionnaire. Eighteen students from the direct entry group completed the survey. Demographic information was collected, including information on ethnicity, age, schooling, academic performance, gender, parental education, family structure, and parental occupation. Descriptive analysis was performed on demographic data to establish the demographic profile of each student group, and to compare the students participating in the FC with the direct entry student sample.

3. Findings

The FC student group were more diverse in their demographic make-up than the direct entry students who completed the survey. Table 1 shows that there are more students with disabilities, from ethnic minority backgrounds, and who have progressed from further education and training, than in the direct entry group. Analysis of the demographics of the two student groups also indicated differences in family structure. The data shows a higher proportion of students entering ITE through the FC are from one parent families in comparison to national averages. In Ireland 18% of all family units are one-parent families (CSO, 2016) while 28% of students in the FC are from one-parent families (Figure 1). In relation to the direct entry student group, there was also a lower representation of students from one-parent families in comparison to national averages (10%). Furthermore, 7% of the FC group were in the care of the State and/or living with a legal guardian, compared to 0% of the direct entry students.

Table 1: Demographic comparison of the FC and direct entry students.

	Think about Teaching	Direct Entry Students
Entrants with Disabilities	4	0
Irish Travellers	1	0
Vocational Training Route	3	0
Further Education	3	0
Migrant background	2	0

Comparison of Family structure
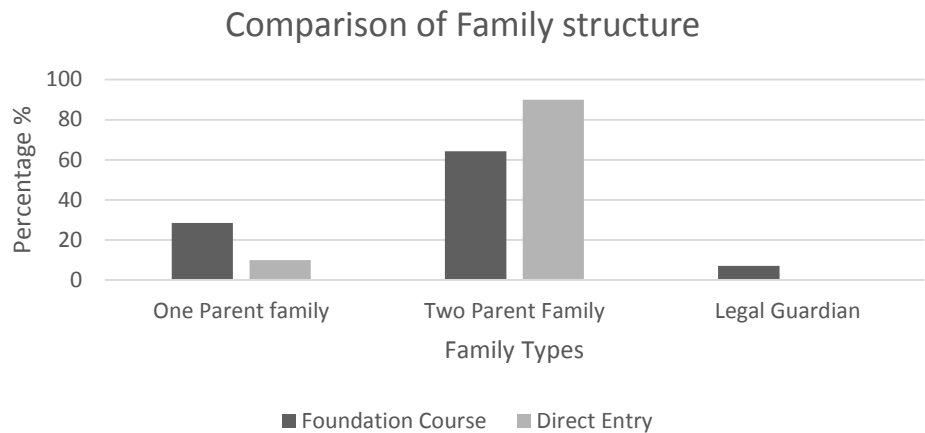
Figure 1: Family structure of foundation course students and direct entry primary teaching students

Results also indicate that the FC students' academic achievements in school were significantly lower than that of the direct entry students. In Ireland the Leaving Certificate is a point system, with the maximum being 625 points. Students sit eight subjects in the final two years of school with the highest grades from six of these subjects are tallied to give a score out of 625. When looking at the average points of the direct entry students we can see that they scored on average 200 points higher than the FC students.

Results indicate that the students utilising the FC had lower levels of cultural capital relating to family history of education, than the direct entry students. Figure 2 shows that students entering ITE directly had a higher proportion of parents who had completed higher and further education compared to the FC students, with 47% of their fathers having only completed junior certificate or below. When considering the education of the students' mothers, 55% of the direct entry students' mothers had completed higher or further education, compared to 20% of the mothers of the FC students. Interestingly 40% of the mothers of the FC students only completed primary school, showing lowest levels of education experience in the mother of the FC students overall (Figure 2).
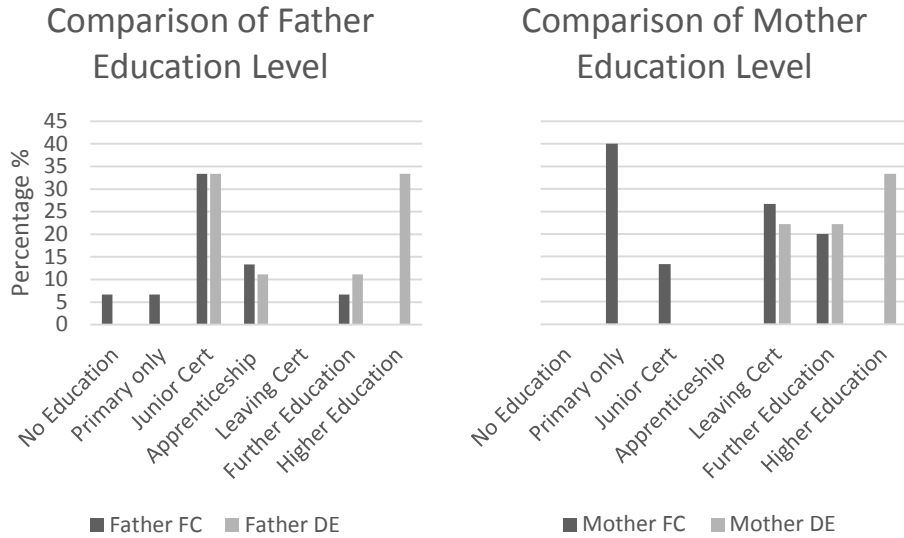
Figure 2: Parent education levels of FC students and direct entry primary teaching students

When comparing the FC students with the direct entry students, we see significant differences in father occupations, with FC students' fathers more likely to work in unskilled, skilled and manual professions, while the father of the direct entry students are more likely to work in higher and lower profession (Figure 3). When comparing the FC students with the direct entry students, there is more variation across the mothers' jobs, and while more FC students' mothers work in unskilled, skilled and manual professions, there is also some representation of direct entry students across these occupations. However, more direct entry students' mother work in higher and lower professions than the FC students (Figure 4).

Comparison of Father Profession
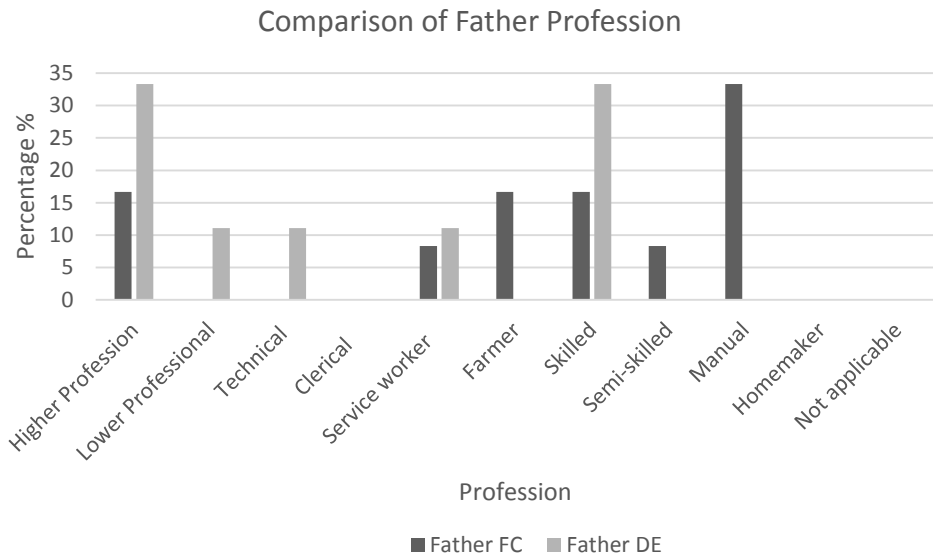
Figure 3: Occupation of fathers of the FC students and direct entry primary teaching students

Comparison of Mother Profession
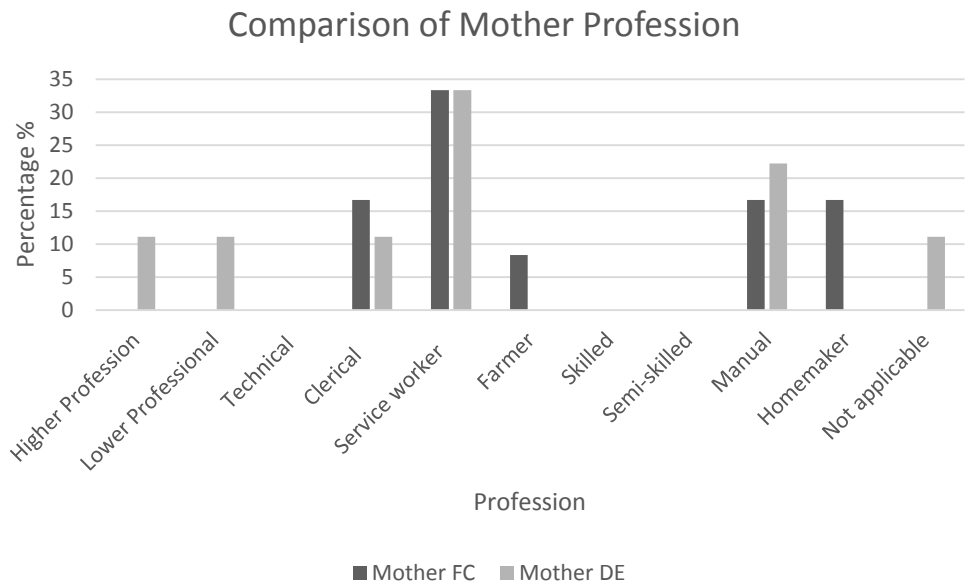
Figure 4: Occupation of the mothers of the FC students and direct entry primary teaching students

4. Conclusion

This research sought to establish the characteristics of students entering ITE through an alternative entry route in Ireland. The results indicate that students utilising the FC are more diverse in ethnicity, disability status and academic history than those entering ITE directly. The FC students are more likely to come from lone- parent families, and have greater levels of disadvantage in terms of family history of education and family occupation, compared to their counterparts who gain entry directly. These results highlight the value of utilising alternative entry routes to ITE, and their potential to support those disadvantaged and underrepresented to take the initial step into ITE. Future research should consider tracking the FC students over the period of the year and into ITE to establish the value these routes offer in terms of diversify ITE.

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Leave no one Behind. Design Inclusive Motor Activities in Primary Teacher Education Courses

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Abstract

The development of international policies supporting inclusive education of people with disabilities has initiated a process of social democratization that requires specific interventions and skills of multiple professionals.

The education of future preschool and primary school teachers faces the challenge of inclusion and becomes fertile soil for the promotion of cultural change in society.

In this sense, starting from the experiences of planning and developing of inclusive motor activities, conducted for three years in the degree course in Primary Education Sciences of an Italian university, this research work collects testimonies, experiences and reflections of the students concerning both the learning gained in the workshops organized by the degree course and those acquired during the observation of the different public schools where they carried out the compulsory training to become teachers.

The results, collected by the qualitative analysis of data, induce different levels of reflection concerning the current schooling educational practices for teaching motor activity, the training needs of future teachers, the elaboration of specific contents and teaching methods/strategies for the preparation of spaces and tools that guarantee the full accessibility of learning for all the students.

Keywords: Inclusive Education; Motor Activity; Teachers' Education.

1. Introduction

The process of school inclusion started in Italy forty years ago since the promulgation of Law 517 in 1977, assuring the access to schooling for disabled pupils in mainstream schools. This innovative reform has produced several changes within the organization of educational institutions, it has enhanced relationships between school, territory and families, and also has improved teachers's professional and educational training, moreover has promoted emancipation opportunities for students with disabilities, these aspects have produced important changes for social integration (de Anna, 2014; Mura, 2016; Pavone, 2015).

"Leave no one behind", could be considered as a clear exhortation to the international community for the rights to a respectable and prosperous life. A recommendation that becomes a call to guarantee to all the students, since the early years of schooling, participation in inclusive educational pathways. These warnings are also present in numerous international documents as UNESCO, International Charter for Physical Education, Physical Activity and Sport 1978, World Conference on EFA, Jomtien, 1990, World Conference of Salamanca 1994 and UN Convention 2006. In particular, Article 30, advocates: "Participation in cultural life, recreation, leisure and sport: 1. States Parties recognize the right of persons with disabilities to take part on an equal basis with others in cultural life [...]".These contents are riaffirmed in the 2012 in *Indicazioni Nazionali per il Curriculum* and in Rules for the promotion of school inclusion for disabled student in n. 66, 2017 Legislative Decree, they are also recalled and renewed in the *Indicazioni e Nuovi Scenari*, 2018. This principles have become an integral part of the learnings provided in the training course for Italian teachers.

In acceptance of these international and national indications it becomes fundamental to train the students of the course of Primary Education Sciences to a *habitus* of pedagogical and didactic skills that is able to recognize the whole person, the pupils with their needs, to develop every potentiality (de Anna, Gaspari, & Mura, 2015; Mura & Zurru, 2016).

2. Lessons, workshops and training: an opportunity to learn about the inclusive potential of Motor Sciences

In the lectures of the last three years, undergraduate students were guided into a path of knowledge of the different potentialities of Motor Sciences. This discipline is a complex domain, an interdisciplinary field of study, characterized by the interaction of the essential contributions of biomedical and humanistic studies (Seclì, 2014; Zedda, 2016). As a core subject in the graduation programme, these contents of knowledge contribute to the understanding of human development and education, becoming preparatory for didactic design. During the lessons are offered information about the motor and postural

development stages of children, the learning and developmental meaning of the game, of the expressive, communicative and relational component as fundamental elements that contribute to the process of growth and awareness of each pupil's body and identity. Movement and game-sports activities are factors that support the interpretation of reality, that guide in the development of knowledge related to health education, and also in civil coexistence and responsible citizenship (MIUR, 2012). All the suggested themes are fundamental elements for the planning and evaluation of motor activities in an inclusive perspective, both for preschool and primary school.

However, it has been explained to students that the involvement in the motor activities of pupils with disabilities it is often hindered by different types of barriers. As pointed out two by researchers (Kasser & Lytle, 2005) the greatest difficulties in inclusive motor activities are identified in three macro elements as personal and contextual factors, and factors related to the task. In this sense and from a perspective of integrated physical activity (Mura, 2011; de Anna, 2009, 2018), it becomes important to intervene with the search for adequate didactics solutions (Mura, 2009). The quality of inclusion is closely related to the teaching competencies, it implies the introduction of elements of innovation that correspond to each one's learning possibilities, independently of their disability condition (Moliterni, 2009, 2013; Mura, 2016; Pavone, 2015). For this reason it was considered appropriate to direct students to develop a systemic operational approach to change perspective and to recognize motor activities' qualities, the body and direct experiences as active, warm mediators that promote everyone's participation (Moliterni, 2013). The students have been solicited to the meta-reflection on the themes of integration and inclusion in motor activities with the knowledge of various experiences successfully carried out in different schools (Magnanini, 2009; Rossi, 2009). This educational path produced two different types of works. In the workshops students worked in small groups to design inclusive motor activities to share with all colleagues. The other works are the result of an oriented and improved reflection by individual students, who have perfected their reflection on inclusion with the planning of inclusive motor activities that have been realized during the direct training, those data became research material for the thesis.

2.1. Students face the challenge of inclusion

In 3 years, the workshop activities involved about 40 university students divided into 7 groups. Each year, at the end of the course, were collected the testimonies of students involved in the workshops, with interviews that highlighted important didactic elements for inclusion:

- basics motor skills are universal principles for the development of all pupils, regardless of whether they show special educational needs;

- basic motor skills are preparatory and transversal to learnings in different disciplinary areas;
- it is necessary to check the conditions of physical and cognitive accessibility of learnings to promote participation of all the students;
- it is also relevant to know the formative value of motor and expressive activities for the creation of a positive communication and relationship between pupils.

From the perspective of professional growth, the students reported that workshops are useful to experiment, in a protected context, how to elaborate and check the project, to learn how to recognize and overcome obstacles to inclusion. Moreover they stated that is important to consider design workshops as an opportunity for share and integrate the different skills gained by colleagues.

Concerning the activities designed and implemented by individual students during the training in preschools and primary schools, they have become an open and complex challenge. In this research were involved 20 female students in training, who have designed inclusive motor activities and they were invited to describe the critical elements encountered in experimentation at school. The collected data describe different aspects, in fact, if on one hand students in training stated that it was necessary evaluate carefully school settings, because sometimes there are architectural barriers to enjoy gym or school's gardens, some other stated about difficulty in managing the time, in fact training time available wasn't enough to carry out all the designed activities. The interviews report that it was therefore necessary evaluate carefully all kind of tools and contents to ensure access and participation to all pupils. In this sense the students in training have highlighted how much time and energy they have committed to find suitable solutions. On the other hand, some students in training stated that it was difficult to share the objectives of the project with school's teachers, so it was necessary creating a climate of mediation, because not all of them show that they have gained knowledge about inclusive motor activities. However, pupils involved in these experiences have shown interest in the activities proposed and for the issues of inclusion. Children have enjoyed a new way of doing motor activity together, because they have been involved in a new cultural model that makes all the students protagonists respecting and recognizing the peculiarities of each one. Engaged in the process of designing and evaluating activities, students in training have reported that they have received multiple input to accomplish the operational evolution from theory to practice in inclusive motor activities design.

3. Motor Activities and inclusive culture

It has become clear that, participation in motor activities and sport is another opportunity to grow together, to learn with peers, to know themselves and each others, to be aware about

each one's body, about own limits and strengths, and is also, above all, is the exercise of a right (de Anna & Covelli, 2016; Mura, 2009; UN, 2006). Nevertheless school experiences described in some students' in training interviews show critical elements referred to architectural barriers and, more relevant, teachers' bias about inclusion in motor activities. The limits to participation, caused by architectural barriers and the absence of adequate tools, are notice of a cultural and institutional inclusion limit that still must be demolished. Certainly, those barriers are related to the absence of a real involvement in motor activities for students with disability. The interviews highlighted this lack of opportunities despite the latest *Indicazioni e Nuovi Scenari* (MIUR, 2018) and also the UN Convention (UN, 2006). By their point of view, students in traninig stated that on one hand some teachers would like to intervene with a medical approach, with the planning of specific motor activities for unique and specific need of each pupil with disability.

The disability of our student is too serious, he would need another type of intervention, in other spaces. It's too serious, don't worry about him, work with others (a primary school teacher).

On the other hand they do not have adequate methodologies to involve pupils with disabilities and so they prefer a policy of non-intervention.

Organizing activities with them is too complicated. It implies to leave the classroom, moreover, you know, they are two pupils with disability ... (a preschool teacher).

Moreover, in three cases, students in training said they had tried several times to share their projects of inclusive motor activities with some teachers, but they do not received a real interest or appreciation towards the proposed work.

I tried for many times to share with them the project, but they told me that I was free to do what I want (an undergraduate student).

Gathering those testimonies and reflections, becomes important to understand the nature of these prejudices, and try to propose possible solutions to fill a gap that could undermine the emancipation objectives achieved in these years.

The fragility of these teaching experiences requires a greater investment of energies and resources. Some studies suggest that it is necessary to invest in training towards inclusive approaches for all teachers, for all disciplines (de Anna & Covelli, 2016; Mura & Zurru, 2019; Zurru, 2015). More precisely and in order to become professionals in the discipline, it is urgent that all the teachers involved in the motor area would be trained both in basic pedagogical skills and in specific skills regarding the body pedagogy (Milani & Crotti, 2016). Greater investment in the dissemination of inclusive practices, also through the motor sciences, can become an opportunity to improve not only individual's skills, but to enhance learning conditions of all pupils. The experiences of motor inclusion proposed

during the lessons and the projects developed by the students in training are potential levers for teaching practices and cultural change. In this sense, it is important to invest both in the training of future teachers and in the updating of teachers in service.

Fostering of an inclusive and integrated education approach, that receives the educational needs of each pupil, requires a continuous effort in pedagogical research of models, strategies and instruments, in a lifelong learning perspective of innovative didactic and educational practices (d'Alonzo, Bocci, & Pinnelli, 2015; Zurru, 2015).

In this educational pathway, which involved university students both in the training through the lessons, the workshops and the traineeships, and it has been realized in three years emerge some useful elements: it's clear that lessons and workshops are opportunities to confront a new operational reality that allows to change own's perspectives respect to the different potentialities of the motor sciences. Moreover Primary Education Science training can become an instrument for the change of the design culture and it can become a quality resource for didactics and teaching. Remodelling their point of view, university students during their training in schools are active guests and promoters of change. They are "spores" for the dissemination of the design of inclusive motor activities, they involve teachers and pupils in theoretical reflection, they seek solutions and answers to unrecognized educational needs, moreover, they collect the children's questions as exhortations to deepen the themes of scholastic and social inclusion.

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Immersive teacher training experience on the methodology of problem posing and solving in Mathematics

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Abstract

In an Italian and European context, one of the fundamental skills in Mathematics is the ability to solve problems in everyday situations, often linked to everyday life. For this reason, the problem posing and solving methodology plays a fundamental role in the process of teaching and learning Mathematics. This paper presents the results of the immersive experience "Mathematical Exploration with Problem Posing and Solving", included in the teacher training activities proposed by the national PP&S - Problem Posing & Solving - Project of the Italian Ministry of Education, which aims at enhancing the teaching and learning of Mathematics by using new methodologies and technologies. In particular, the focus will be on the work and considerations of the 50 teachers who took part in the project, from both primary and secondary school. They were guided through the individual step-by-step creation of a contextualized problem, following a process guided through stimulus-based questions. This immersive experience brought about the production of valid problems and was full of very stimulating teachers' considerations on the various phases of the problem posing and solving.

Keywords: Contextual teaching; Contextualized problem; Mathematics Education; Problem posing; Problem solving; Teacher Training.

1. Introduction

The Problem posing and solving methodology plays a fundamental role in the process of teaching and learning Mathematics and in promoting a process of mathematization and modeling of reality (Baroni & Bonotto, 2015). As explained in many Italian national documents, the teaching of Mathematics should start with the use of language and mathematical reasoning as tools for the interpretation of reality and not only as baggage of notions (Unione Matematica Italiana, 2001). The characteristic of mathematical practice is the solving of problems, which has to be considered as an authentic and meaningful task, often linked to everyday life, and not only as a repetitive exercise or question to answer by simply recalling a definition or a rule (MIUR, 2012). Also at a European level, mathematical competence is described as the ability to develop and apply mathematical thinking and intuition to solve a series of problems in everyday situations (European Parliament and Council, 2018). A change in the teaching of Mathematics has therefore become necessary and in 2012 the Italian Ministry of Education engaged in an action aimed at improving the quality of the educational process by acting on teachers' training through the PP&S (Problem Posing and Solving) Project (Brancaccio et al., 2015). The project promotes the training of Italian teachers of lower and upper secondary schools on innovative teaching methods, supported by the use of ICT and the creation of a culture of Problem Posing and Solving (Barana, Fioravera, & Marchisio, 2017b).

This paper discusses a teaching training experience which took place during a 2 hours immersive workshop, "Mathematical Exploration with Problem Posing and Solving", at the Didacta Italia 2018 Fair. The workshop is included in the teacher training activities proposed by the PP&S; other activities are: face-to-face training, online training modules, weekly online tutoring, online asyncronus collaboration and collaborative learning within a learning community (Barana et al., 2018a).

2. State of the art

2.1. Problem Solving

The term "problem-solving" refers to mathematical tasks that have the potential to provide intellectual challenges for enhancing students' mathematical understanding and development (National Council of Teachers of Mathematics, 2000). One of the objectives of Mathematics learning is to solve the problems that include the ability to understand the problem, devise a mathematical model, develop the solving process and interpret the obtained solution (Samo, Darhim, & Kartasasmita, 2017). Mathematical problems are central in mathematical practice in order to develop the discipline and to foster student learning (Pólya, 1945). Mathematics should not be considered different from the possible daily activities of the students. A real situation in which the student might find himself can

be used to propose a problem, in order to bring together the teaching and learning practices of school Mathematics and the wealth of experiences that students develop outside of the school (D'Amore & Pinilla, 2006). According to Samo, Bana and Kartasasmita (2017) "contextual teaching and learning is a learning which links the material with the real-world context of students' everyday life either within family, community, environment, and the world of work so that students are able to make connections between knowledge possessed by its application in everyday life". In fact, problem solving can stimulate interest and motivation towards the study of Mathematics by creating a bridge between school and extracurricular Mathematics, bringing out realistic considerations and developing modeling skills (i.e. recognizing when and how to use subject knowledge to address and solve problems in hands-on situations in the real world) (Baroni & Bonotto, 2015). Furthermore, by solving mathematical problems students acquire ways of thinking, habits of persistence and curiosity, and confidence in unfamiliar situations that serve them well outside the Mathematics classroom (National Council of Teachers of Mathematics, 2000). In order to gain experience on problem solving, students should solve various types of problems in their own way on a regular basis and over a prolonged period of time. Non-routine problems and open problems should be used to offer students a wide range of possibilities for choosing and making decisions. Students' resolution of a problem can be used to evaluate progress in the problem solving skill, using a rubric score scale (Leong & Janjaruporn, 2015). The analysis of the ways in which mathematical problems are formulated and of the process involved in solving problems generates important information to structure learning environments in order to guide students' construction of mathematical concepts (Liljedahl, Santos-Trigo, Malaspina, & Bruder, 2016).

2.2. Problem Posing

Problem posing is an important component of the Mathematics curriculum, and it is considered to be an essential part of mathematical doing (National Council of Teachers of Mathematics, 2000). It involves the creation of new problems and questions aimed at exploring a given situation as well as the reformulation of a problem during the process of solving it (Lavy & Shriki, 2007). Kilpatrick (1987) marked a historic milestone in research related to problem posing: he pointed out that problem formulating should be viewed not only as a goal of instruction but also as a means of instruction and that the students should be given opportunities to live the experience of discovering and posing their own problems. Kilpatrick also pointed out how all problems that students solve have been posed by another person, but in the real life many problems are created or discovered by the solver, who gives the problem an initial formulation (Liljedahl et al., 2016). According to Lavy & Shriki (2007), providing students with opportunities to pose their own problems can foster more diverse and flexible thinking, enhance students' problem solving skills, broaden their perception of Mathematics and enrich and consolidate basic concepts.

Stoyanova and Ellerton (1996) considered mathematical problem posing as "the process by which, on the basis of mathematical experience, students construct personal interpretations of concrete situations and formulate them as meaningful mathematical problems" (p. 519). They identified three categories of problem-posing situations: free, semi-structured, or structured. In free situations, students pose problems without restrictions; semi-structured situations refer to those circumnstances in which students explore a given open situation and they have to complete it; in structured situations students pose problems by reformulating already solved problems or by varying the conditions of given problems (Singer, Ellerton & Cai, 2015).

In conclusion, problem posing is an opportunity for interpretation and critical analysis of reality since: (a) the students have to discern significant data from immaterial data; (b) they must discover the relations between the data; (c) they must decide whether the information in their possession is sufficient to solve the problem; and (d) they have to investigate if the numerical data involved is numerically and/or contextually coherent.

2.3. The problem posing and solving in the PP&S Project

In the PP&S Project, we add two further aspects to problem posing and solving:

- use of an ACE (Advanced Computing Environment) for problem formulation, presentation, resolution and generalization (Barana, Fioravera, & Marchisio, 2017a);
- automatic formative assessment with adaptive questions aimed at teaching students how to solve problems, guiding them step-by-step with interactive feedback in the solving process, through an ACE and an AAS (Automatic Assesment System) (Barana, Conte, Fioravera, Marchisio, & Rabellino, 2018b; Barana, Fioravera, Marchisio, & Rabellino, 2017)

Within the PP&S Project, the activity of problem posing and solving, strongly characterized by cooperative learning, can be carried out face-to-face among students, in their classrooms or computer lab or among students at a distance, within a VLE (Virtual Learning Enviroment) dedicated to each class. At the same time, teachers develop problems for their students at a distance, within a VLE dedicated to the community of PP&S teachers throughout Italy, who also collaborate with each other exchanging ideas, teaching strategies and materials reviewed and tested in their classes (Barana et al., 2018a). They also develop problems in collaboration with the tutors at a distance during the online training sessions (weekly tutorials and periodical training modules). To increase teachers' awareness of the use of problem posing and solving we proposed an immersive experience, in the form of a workshop, entitled "Mathematical Exploration with Problem Posing and Solving", in which we focused on the work of teachers in creating problems, in order to suggest a change of

perspective. The 50 teachers who participated teach from primary to upper secondary school (students aged 6 to 18) and they teach Mathematics or other scientific subjects.

3. Methodologies

The experience was developed in three different moments:

1) Presentation of an example of a contextualized problem for the explanation of the four phases of the problem posing and solving process (problem design, text formulation, construction of the solution process, generalization of the resolution to abstract the solution process);
2) Individual step-by-step creation of a contextualized problem by the teachers following the above mentioned phases through stimulus-based questions;
3) Compilation of questionnaires. A common topic was assigned to all the teachers for the development of the problems: variation of a quantity according to another quantity, which can include mathematical concepts such as proportionality, rate of variation, incremental ratio.

Teachers were asked to think about a very specific class for which to create the problem. To analyze the considerations of the teachers on the problem posing and solving process we used the following tools: initial questionnaire, problem created by teachers, and teachers' answers to stimulus-based questions of the first two phases. For the first phase, they were: "Did you find it difficult to choose a contextualization? If yes, which ones?", "For what reasons can the contextualization chosen be effective?". For the second phase they were: "Did you encounter any difficulties in writing the text of the problem? If yes, which ones?", "What difficulties do you think students can encounter when interpreting the text of the problem?".

4. Results

Of the 50 teachers who participated in this experience, 7 taught at primary school, 24 at lower secondary school one of which a special needs teacher) and 19 at upper secondary school. Primary teachers taught various subjects (including Mathematics and Science), while secondary teachers taught: Chemistry (1), Physics (1), Mathematics (16), Mathematics and Physics (5), Mathematics and Science (20); except for 13 teachers, all had been teaching for more than 10 years. Most of the teachers said that they regularly used problem solving as a teaching strategy during their lessons (Figure 1), and only 3 teachers (from secondary school) never or rarely used it.
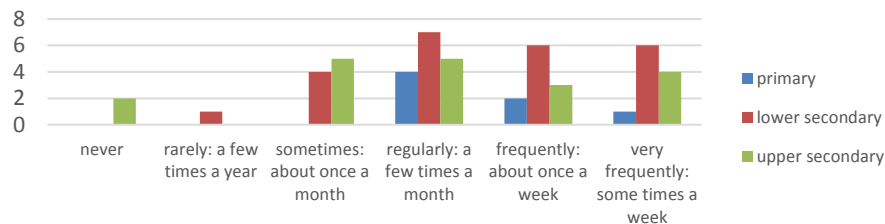
Figure 1. Frequency of use of problem solving as a teaching strategy (2018).

Some teachers preferred to work individually, while others preferred to work in pairs or groups of 3 or 4; the groups were spontaneously formed and in some cases teachers of different degrees or subjects worked together. At the end of the immersive experience, 25 different problems were produced. All of them are characterized by a contextualization in the real life and familiar to the students, for example charging the phone, school trips, going to the cinema, athletic preparation of a team, cooking recipes, interpreting bills. When we asked them why they chose a particular contextualization, the teachers said: "it is part of the experience of the students"; "to stimulate the observation of the places they live in", "because it allows comparisons with other disciplines". Half of the teachers had difficulties in choosing the contextualization. Some common difficulties were: connecting the theory to topics and problems that can engage students; creating texts (because they usually draw from books), little practice in designing real-world tasks and in finding real examples that can be translated in mathematical terms in a simple way. 86% of teachers said they had difficulty in drafting the text of the problem, for example in being clear and correct in the formulation of the text, in the choice of which data had to be given and which did not, or in the translation of the idea into a text. 62% of teachers decided to create a problem in which some data are open, in order to invite the student to explore the data. But, as one of the teachers stated, "leaving some data to look for makes the problem more real and stimulating, but data must be chosen wisely by the teacher". A problem with "too open" data could confuse the student who does not know how to set the solving process. An example is the following problem created by a teacher during the workshop: "Two friends who live in different places decide to meet and have to organize the trip. If they leave the same day at the same time and proceed at a constant speed, where will they meet?". Below we will show two examples of very interesting problems developed during the workshop, the first one by a primary school teacher and the second one by an upper secondary school teacher.

1) The cook of the school asks children of the fourth year to help her choose the amount of pasta to cook. There are 24 students and for each one the cook prepares 60g of pasta. How many kilos of pasta does the cook need? And what if 5 children were absent?

2) Consider your mobile phone with its specific watts (which can be found in the phone specifications). Knowing that the Italian home network supplies 230 V, what is the charge needed to fully charge your mobile phone? And what would it be if you were in another country of your choice?

Both problems have a real context very familiar to students, in the second case some data are intentionally left open (the loading time of the phone). Moreover, both lead to a coherent generalization of the resolutive process (in the first one by varying the number of students in one class and in the second one by choosing the country). In the problem solving phase, the teachers focused on the conceptual nodes involved and on the difficulties that their students might encounter; some teachers were more concerned about the use of contextualized problems, while others were concerned about their students' skills.

5. Conclusions

The immersive experience led to the production of valid problems and was full of very interesting ideas. The teachers reflected upon the various phases of the problem posing and solving and on the difficulties their students might face in solving the problem, making them more aware of the activity they offered. This is why the same immersive experience can also be offered to the students. The results show that the experience can be presented at all levels and can facilitate dialogue between teachers who teach at different schools and different disciplines.

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Nurturing students'awareness of their behavioral competencies: The Competency Lab experience

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Abstract

Behavioral competencies, also defined emotional and social competencies (ESCs), are considered to be increasingly important for graduates' workplace readiness. Drawing on studies that adopt the "whole person" learning approach and the Intentional Change Theory (ICT), this paper illustrates a teaching approach that higher educational institutions should implement, across different curricula and disciplinary fields, in order to improve students' awareness of their behavioral compentecies and to direct their development coherently with the future professional and personal objectives. In doing this, we give an illustration of the lessons learned from an educational initiative, Competency Lab, designed by a research center of a public university in Italy, that was devoted to master's students. From the analysis of the students' learning outcomes, the paper shows the positive impact of : i) proposing the ICT approach, through which students assume personal responsibility for the development of ESCs; ii) integrating multiple learning methods and tools with a specific application of experiential methods to stimulate self-reflection and active experimentation; and iii) encouraging students' engagement through web-based technologies. We provide implications for educators illustrating how students can self-define the ESCs to develop, following a rigorous method that is tailored to their specific level of maturity and personal motivation.

Keywords: Behavioral competencies; emotional and social competencies; higher education; intentional change theory; experiential learning; whole person learning.

1. Introduction

The positive effect of behavioral skills or emotional and social competencies (ESCs) on successful individual performance across sectors and jobs has been widely acknowledged in the literature (Boyatzis 1982; Hopkins and Bilimoria 2008; Spencer and Spencer 1993). These competencies have not only been demonstrated to be relevant antecedents for work-related outcomes, but are also considered crucial for graduates' labor market entry (Hoover et al. 2010). Some cases in which behavioral competencies have been introduced in the academic setting have been illustrated in prior studies (e.g. Chen et al. 2004; Sheehan et al. 2009; Waddock and Lozano 2013). Despite the new insights provided by these educational experiences, they show some limitations. First, they aim to develop only one or a limited number of competencies, especially social ones like teamwork or leadership, instead of providing students with a methodology for becoming aware of their their overall portfolio of competencies and promote its development coherently with their future career objectives. Second, they may engage students with experiential techniques for promoting self-reflection and active learning, but it does not provide the participants with a structured plan in order to practice competencies after the classroom activity and pursue a long-lasting change in their behavior. Lastly, these courses can often be attended only by students enrolled in management curricula. Research has shown that behavioral competencies are crucial skills in every job and every sector, and therefore their development does not pertain only to specific disciplinary areas.

A different methodological approach to competency development has been proposed by those educational programs that have implemented the "whole person" learning approach and Intentional Change Theory (ICT) to skills development (Barbera et al. 2015; Boyatzis and Saatcioglu 2008; Hoover et al. 2010). These studies show that the development of behavioral competencies requires students' engagement in the intentional change process (Boyatzis 2006). Indeed, "learning does not occur until the learner makes it happen" (Hoover et al. 2010: 194). The effectiveness of the "whole person" approach has been demonstrated in longitudinal studies that assess the learning outcomes, in terms of variation in competencies, in full-time MBA programs (Boyatzis and Saatcioglu 2008). However, these experiences have introduced the development of ESCs as a single module/course within a business master's program or executive program, without a systematic approach to the development of graduates' competency at the university level.

Considering the aforementioned limits in the extant academic courses, the main purpose of this paper is to present a didactic approach that HEIs should consider in order to improve students' awareness of behavioral compentecies and to direct their development throughout their career path coherently with the students' future professional and personal objectives.

2. Behavioral competencies awareness: The Competency Lab experience

Since the need for the development of students' soft skills has become more pressing, as a result of growing demand from the labor market, an Italian public university decided in 2012 to establish a center (the "Competency Centre"). This was the first academic center in Italy to concentrate on conducting research, training and consultancy activities in the development and assessment of soft skills. The mission of the Center was, from the beginning, to improve people's performance and employability through the development of their emotional and social competency portfolios. With specific regard to students, among its educational initiatives, the Competency Centre designed the "Competency Lab," a cycle of four interactive seminars (for a total of 15 academic hours and three academic credits) that aim to guide the participants through a process of becoming aware of their behavioral competencies. During each academic year, the Centre organizes four identical editions of the Lab. For each edition, a maximum of 40 students are admitted through an online enrollment system. Students from all the different disciplinary areas taught at this university (economics, management, humanities, languages and science) can apply to the Lab on a voluntary basis. The personal motivation represents a prerequisite for attaining effective learning outcomes. For this reason these didactic activities are not mandatory in the academic curricula.

2.1. Structure of the Competency Lab

The Competency Lab requires students to attend four classroom seminars and to carry out some assignments on a digital platform developed by the Center to support participants with the ICT discoveries or discontinuities (Boyatzis, 2006). These discoveries can be associated with "wake-up calls" or moments that awaken the person to the need to consider a change and that lead to successive improvements in behavior and subsequent competency development (Kolb and Boyatzis 1970; Boyatzis 2006; Leonard 2008).

In the first seminar, students are introduced to the ESCs, their impact on performance, and their relevance for employability. The ICT process is then illustrated and the first discovery (ideal self) is explained, which will lead students toward a mindful reflection on what matters most to them and on who they want to be. At the end of the first seminar, students are asked to do some assignments on their dreams, passions, and inner values by accessing the digital platform, and they complete these assignments before the second seminar. The assignments given are based on the work of McKee et al. (2008).

In the second seminar, drawing on their preliminary reflections on their ideal self, students are trained to conduct a peer coaching session and then take part in such a session. The starting point of the peer coaching proposed during the Competency Lab is helping the peer to achieve a deeper level of analysis and reflection on his/her own values, passions, and future dreams, to make hidden assumptions explicit. After the peer coaching session, students are asked – as an assignment that is due before the next seminar – to draft their "personal vision

statement," which should be at least 1,000 words long, and in which they should describe in detail their desired life between seven and ten years into the future. The instructor provides guidelines for developing a compelling personal vision and associating it with those ESCs that are needed to attain the students' desired future. Indeed, in order to allow students to use the personal vision as the driver of change and as a tool to direct their efforts, the students have to identify, explain, and rank the emotional and social competencies needed to attain their personal vision. In so doing, and helped by the instructor who gives them feedback, they are spurred to make explicit their assumptions about the relationships between their future goals and the behavioral competencies required to obtain them, independently from how often those competencies are actually manifested. After this, the second discovery (real self) is introduced, and students are involved in both a self-assessment and a multisource assessment of their ESCs through external raters who are invited to the digital platform by the students. These external raters, chosen from among the student's personal and/or professional contacts, have to know the student well and to have observed him/her in action, and they are asked to provide an open, honest, and anonymous judgment to help the student identify the competencies that he/she demonstrates most and those that he/she demonstrates least. The ESCs framework adopted in this step is the Emotional and Social Competency Inventory – University Version (ESCI-U), which has been widely adopted in academic and organizational settings (Boyatzis and Goleman 2007; Boyatzis and Sala 2004), integrated with three additional competencies. The questionnaire encompasses 79 items to evaluate 17 competencies: six emotional competencies (emotional self-awareness, achievement orientation, adaptability, emotional self-control, positive outlook, and conscientiousness), nine social competencies (empathy, organizational awareness, service orientation, conflict management, coach and mentor, influence, inspirational leadership, teamwork, and change catalyst) and two cognitive competencies (systems thinking and pattern recognition).

The third seminar allows students to become aware of their strengths and weaknesses, and helps them to understand which competencies they need to develop in order to achieve their ideal self. Specifically, during the class meeting, students receive a personal report on their ESCs profile collected through the self-assessment and the 360-degree assessment. The multisource feedback enables students to reflect on their strengths (competencies that are both indicated as necessary if they are to obtain their personal vision and that they demonstrate most) and weaknesses (competencies that are indicated as necessary for their personal vision but that they demonstrate less). Afterwards, they are involved in a second peer coaching session, where they are asked to support each other in reflecting, through the narration of critical events, on how the competencies that have emerged as their strengths and weaknesses grew out of their past, and on how these competencies can help them to pursue their desired future.

In the fourth and last seminar, the labor market expectations – in terms of graduate competency profiles – are discussed through the experience of companies specializing in recruitment and selection. Simulated job interviews that aim to evaluate ESCs, as well as suggestions on how to emphasize soft skills in the recruiting process, are provided.

2.2. Learning outcomes of Competency Lab

From its launch in 2013 until November 2018, the Competency Lab has involved 556 graduates. Approximately 63 percent of the students came from the Economic/Scientific disciplinary fields and approximately 37 percent from the Humanistic/Linguistic disciplinary fields. Dara on learning outcomes are collected online approximately two weeks after the end of the didactic activity.

Concerning the discovery of the ideal self, 88.79% of the graduates (students who selected the "6-agree" and "7-completely agree" response options on the seven-point scale) found the self-reflection exercises useful for pondering the person they wanted to be and their desired future. The findings also highlight the effectiveness of the personal vision in supporting students as they set their objectives for the future (81.80%). Some comments provided by the students on the first ICT discovery are the following: "*The introspective analysis that I carried out on myself further opened my eyes to new possibilities, helped to rediscover my old passions, understand my priorities and how I can achieve my future*"; "*I felt stimulated and motivated to project myself in the future. Before attending this laboratory I had no idea of what I would do after graduation*".

The discovery of the real self allowed students to understand their level of use of ESCs better (87.32%). In some cases, the participants felt surprised by the external raters' comments on their strengths and weaknesses. The mismatch between the personal and others' perspectives triggered the students to reflect further on their behaviors, increasing their self-awareness. Almost 85% of the participants agreed that this discovery helped them to identify those ESCs that they needed to develop. Some comments provided by students are the following: "*I expected the strengths that the external evaluators emphasized. Initially, after the first reading of the real self feedback I was surprised about the weaknesses they indicated, but reflecting on them after the meeting I understood that they are not so wrong as I initially thought*"; "*The feedback I received enabled me to be more aware of how others see and perceive me, to understand my potentialities and limits and to become more confident that I can improve them*".

Concerning the classroom lectures, the students appreciated the use of videos and movie clips as an effective method to identify in practice the behaviors related to the emotional and social competencies (93.25%). One comment was: "*I found some videos watched during the class very useful and the exercise to identify the competencies manifested by the characters through the observation of their behaviors. Videos helped me to better understand the*

meaning of the different competencies and how they can be manifested in concrete situations."

The participants regarded the peer coaching activity as stimulating but at the same time challenging, and this is confirmed by the lower percentage of satisfaction for this in comparison to the other learning methods (66.23%). Specifically, the participants required more time to become familiar with the technique (the coaching session usually lasts 30 minutes), and they found some difficulties in playing an active and supportive role as a coach for their classmates, while asking provocative and difficult questions to help their peers to advance in their learning paths. However, this technique was positively evaluated by the students when they were being coached, as they saw it as a means to clarify their goals and to stimulate self-enquiry. Some comments follow: "*Peer coaching activity was really useful. Speaking with people that I did not know helps a lot to lay myself bare*"; "*Peer coaching was undoubtedly useful especially because you have to speak with people who you do not know. This forced me to be as clear as possible about my objectives and my personal characteristics. Peer coaching spurred me to avoid speaking in vague terms and to be more precise.*"

The meetings with representatives of the labor market were evaluated as useful at the highest level by 78.79% of the students. They specifically mentioned the possibility of gaining a better understanding of firms' expectations, and receiving valuable insights and suggestions about how to highlight ESCs during job searches.

3. Discussion

From the methodological point of view, the case analysis advances the understanding of how the "whole person" learning approach and the ICT can be effectively tailored to the needs of graduates from different disciplines. In contrast to previous academic experiences that focus on the development of specific competencies defined at the institutional level or by instructors, the paper shows how learning goals, in terms of ESCs, can be defined by students in a way that matches their professional and personal future vision and that follows a rigorous method. For this reasons, the students feel more motivated and engaged in the process of intentional change, maintaining a high level of commitment to their objectives.

Moreover, the findings outline how classroom lectures and experiential approaches complement each other in encouraging self-reflection and active learning. The empirical evidence showed that students need to understand the meaning of ESCs and to observe how they can be manifested in practice, confirming the important role of vicarious learning methods. Furthermore, lectures provide students with guidelines for performing the assignments related to each ICT discovery effectively and acquiring the declarative knowledge necessary for engaging in experiential learning activities. Our research shows that

individual and social experiential approaches like self-reflection, peer coaching, actual experimentation, and group conversations, can be effectively proposed, not only for practicing specific competencies but also to direct the personal learning process toward the definition of the competencies that an individual wishes to learn.

The case provides also evidence of the effective integration between classroom activities and online learning. The Centre has implemented a web-based platform through which students can access assignments and materials at the different stages of the learning process. First, the platform plays an important role in the coordination of the activities between students and instructors. Indeed, the instructor assigns a deadline for each assignment that relates to the material that will be discussed in the upcoming classroom session. Moreover, the instructors can add comments to the assignments, like the vision statement, that are crucial for directing the learning process. The instructors may also decide to give the students access to feedback before or after the class for pedagogical reasons. Second, since the proposed activities require deep reflection that can take place over a week or two, the digital platform provides flexibility that allows the assignments to be carried out anytime and anywhere depending on the individuals' availability. Finally, the platform generates outputs that can be used by the students to increase their self-awareness further.

4. Conclusion

Our research suggests important implications for the development of ESCs in university settings, as well as promising avenues for future research. First, universities should formally recognize the development of ESCs along with the delivery of professional/technical skills in their educational mission. For this reason ESCs should be taught autonomously from courses in specific disciplines, in order to guarantee effective learning outcomes. This requires the recognition of the strategic relevance of soft skills, and commitment at the institutional level, so that all faculty members are engaged in the design of dedicated programs on ESCs across different master's degrees. The case illustrated has offered new methodological insights for HEIs, and it can be replicated in other higher education settings. Second, to pursue the effective development of ESCs, students need to be supported in setting their own learning goals. Instructors may assume the role of learning facilitators rather than of transmitters of knowledge, giving more space for participants' reflections and interaction, and providing personal feedback to direct their change.

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Students' Self-directed Learning in the Context of Industrial Challenges: Latvia University of Life Sciences and Technologies Case

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Abstract

Students' self-directed learning (SDL) is analysed as a means to promote the development of professionals who are active life-long learners, ready to complex problem solving, leadership and flexible adaptation to social and economic situations. That is why the aim of the study was to analyse the components of SDL essential for nowadays socio-economic situation and to find out SDL results from the students of Latvia University of Life Sciences and Technologies (LLU). The method of questionnaire was used to investigate the students' self-assessment on their SDL focusing on purposefulness, motivation for knowledge, implementation of effective learning strategies, responsibility, control assessment of learning progress, importance to express one' s view and time management. The results of the study were obtained from 305 first-year students of LLU. Medium results dominate in relation to implementation of effective learning strategies, importance to express one's view and time management. It means that preferably an electronic aid on learning strategies and more flexible learning environments for the first year students is necessary. The study results also indicate that more teaching methods promoting views expression are of high importance and should be included in further education courses for teachers.

Keywords: Self-directed learning; university students; professionalism.

1. Introduction

The study of self-directed learning (SDL) is topical because this process depends on socio-economic changes in the world having an impact on the demands in higher education. The situation is that not all students are ready for self-directed studies because getting of higher eduction is very popular among young people but not all of them are motivated for deep and research-based studies. Therefore it is necessary to find solutions how to promote students' learning considering self-directed studies indicators.

That is why both theoretical and practical assessment of SDL understanding, components and cases is necessary considering the statements of European Higher Education Area (EHEA) and on global processes. The study covered the conclusions of Bologna process ministers meetings, World Economic Forum 2018 and researches of teaching/learning in higher education.

Ten aspects as competitiveness, investing in people, globalization, open economies, innovation ecosystems, development of technologies and institutions, infrastructure and the financial system, constant change and agility, equality, sustainability and growth together are relevant for governments in the fourth industrial revolution (World Economic Forum, 2018). They relate to social, economic, ecological situation in nowadays world and mark the directions important to consider in the education of future oriented, flexible, competent and proactive specialists.

Forthcoming specialists mainly are tended to find their place in a labour market and that is why students' SDL is focused on professional development. Both labour market and professional development are dynamic concepts influenced by demands of society, technological progress, ecology and development of industries and trade. Students need clear understanding of both concepts and their changeable character in today's situation, in the nearest and further future to guide their SDL purposefully.

That is why the aim of the study was to analyse the components of SDL essential for nowadays socio-economic situation and to find out SDL results from the students of Latvia University of Life Sciences and Technologies.

2. Research methodology

The theoretical studies on professional and SDL development, and perspectives, cognitions of future skills for the labour market put forward by World Economic Forum 2018 and topical learning outcomes defined by Bologna process Paris meeting in 2018 had been carried out.

There were ranged the data (R) and their distribution got from the first year LLU students taking the highest level answers as an accounting point.

The method of questionnaire to investigate 305 LLU first year students' self-assessment on the development of SDL had been carried out in autumn 2018.

Respondents represented the fields of agriculture, forestry, veterinary medicine, economics, food technology, engineering, landscape architecture, land survey and information technologies.

Students marked high (h), medium (m) and low (l) level of purposefulness, motivation for knowledge, implementation of effective learning strategies, responsibility, control assessment of learning progress, importance to express one's view and time management.

The obtained results can be used in making an electronic learning aid for students and revising the courses for LLU academic staff and implementation of methods and content promoting better reaching of learning outcomes.

3. Theoretical results

The concept of professional development is analysed in every decade and it reflects the nature of the epoch. Professionalism should be proved and it means that a person has to demonstrante it. According to D. Schön (1983) it is possible to determine such key words for professional's action as "creative approach", "practical experience in a highly intuitive manner", "reflection" on things being done which is summarized in „reflection-in-action". This kind of reflection happens immediately in action and involves critical thinking and it is „..to some measure conscious". Demonstration of competence in creative work requiring situations involves practical experience in combination with intuition and reflection during action.

K. Paechter (1996, 347) more than two decades ago in her study on professional development mentioned that "Professionals know what they are doing – they have expertise. They have usually undergone some training or at least undertaken extensive practice of their skills and development of their knowledge". It is also mentioned that the professionals are not always tested in examinations but it is possible "to exclude some individuals from further membership, on specific grounds such as incompetence or dishonesty". K. Paechter (1996, 247) also relates to the professionals such key words as "get paid what they do", ethics, "autonomous action" and "carry out their work in an emotionally neutral manner".

The situation today is that we are in the period of the Fourth Industrial Revolution (4IR) and it draws corrections in the understanding of professionalism as well. The main features of the 4IR are digital technologies, smart industries with such basic elements as IT and

artificial intelligence (AI). K.Schwab (2016) mentions that the challenges for humans are management of smart devices and technologies, adaptation to quick changes of them and not to become robotised as well as humans need to develop creativity, empathy and stewardship.

World Economic Forum (WEF) (2018) named 10 top skills in the labour market after 2022, for example, analytical thinking and innovation, active learning and learning strategies and complex problem-solving. They point to the development of autonomous personality able to act appropriately in changing and complex situations when a rapid development of innovations including technologies and artificial intelligence is going on. The skills put forward by WEF 2018 meets the investigation results by Deloitte Global CEO (Preparing tomorrow's workforce…, 2019, 16) where four main skill categories as workforce readiness, soft skills, technical skills and entrepreneurship relevant for the 4IR are stated. Life-long learning as a "continuous process of gaining new knowledge and skills as individuals progress through their professional and personal careers" unites all the four skills categories.

The stated skills is a big challenge for educators in higher education because it is necessary to understand the processes in labour market and forecasts of workforce strategy. It means that higher education has to promote the development of professionals who are active life-long learners, ready to reskilling, leadership and flexible adaptation to social and economic situations.

Ministerial Conference Paris (2018) published revised learning outcomes in the Qualifications Framework for EHEA comprising the qualifications from the short to the third cycle. In the short cycle readiness to further education and employment capabilities are particularly emphasized. In the second cycle professional approach as well as "ability to integrate knowledge and handle complexity, and formulate judgements with incomplete and limited information". A special attention should be paid to the first and second cycle qualifications focusing on learning outcomes justification with SDL. These two qualification levels include the largest mast of students which will meet labour markets demands and SDL should be an actual tool reach better learning outcomes and be successful in labour market.

Considering the ideas from the last three decades it is possible to derive several dimensions of professional development: skilfulness in the field with tendency to receive an expert level; autonomous action; life-long learning; social skilfulness; ability to adapt to social and work situations; ethics in work and social situations; creativity; divergent and convergent thinking; innovations. The dimensions could be as milestones to make SDL more focused.

SDL as autonomous and necessary skill for the 21st century is investigated by a lot of higher and adult education researchers (Cox, 2015; Giddings, 2015; Guglielmino, 2013; Henschke, 2016; Wilcox, 1996).

SDL means a teacher's democratic position and values, usage a lot of teaching strategies as well as creating a situation that students feel free and are not afraid to make mistakes. "Self-directed learning as an instructional method, as previously mentioned, like any method or pedagogy, is likely adopted based on the professor's personal values or preferences for instruction. This is where self-directed learning becomes a teaching philosophy" (Cox, 2015, 22).

Development of experiential learning could be a serious contribution to the process of SDL. According to Escalante & Aguilar-Barrientos (2017) it comprises critical and creative thinking. Those two qualities play an important role in autonomous and initiative behavior and can be promoted by interactive methods and formative assessment.

SDL is a means to prepare oneself for changing life conditions. At the same time the components of SDL have to be revised because forecasts of dynamic social and economic changes have to assessed and integrated into comprehension of SDL. The process of SDL is two-sided. Students have to be active assessing their learning outcomes which are understood as knowledge, skills and competence, and the process of learning including cognition, activity, purposefulness, learning strategies and problem-solving from one side. The students also have to be active followers of world's socio-economic processes and they have to develop the qualities helping them to be successful professionals in the processes of the changing labour market from the other side.

Considering the present socioeconomic situation SDL is a process where students are purposeful, with initiative and responsibility controlling and assessing the progress of their learning outcomes. The students are autonomous learners able to carry out effective learning strategies, manage time and understand the importance of life-long learning.

The key phrases and words of: the future labour market demands towards a professional's skills, professional development, learning outcomes of the first cycle qualifications and SDL are reflected in Table 1 with the purpose to find out conjunctive elements and incompatibilities. The comparison will help to complete SDL and make it a better tool for reaching learning successes and be ready for labour market demands.

Table 1. Key words and phrases for professionalism, learning outcomes and SDL

Professionalism	Learning outcomes (Ministerial Conference Paris (2018)	SDL
usage of experience; reflection in action (Schön 1983); ethics in work and social situations; autonomous action; life-long learning; from skillfulness to expertise; rapid adaptation to smart technologies and reskilling; stewardship; flexible adaptation to social, work and economic situations; analytical thinking; creating innovations; social skilfulness; analytical, systemic, critical thinking and innovation; complex problem-solving; creativity; humanism; emotional intelligence	ability to integrate knowledge and handle complexity; formulate judgements with incomplete and limited information; apply knowledge and understanding in a manner that indicates a professional approach to work or vocation; have competences through devising and sustaining arguments and solving problems within their field of study; have the ability to gather and interpret relevant data including reflection on relevant social, scientific or ethical issues; can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences; have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	critical and creative thinking; experiental learning; controlling and assessing learning progress; skillful usage of learning strategies; problem-solving; active following of world's socio-economic processes; expressing views; autonomous learners; manage time; understand the importance of life-long learning; purposeful learner; with initiative; responsible learner

Indicators of professionalism and learning outcomes highlight the actual focus of learning and there is a conjunction among them because their nature correspond to each other or even coincide. SDL indicators also correspond and therefore they function as an actual tool for reaching the learning outcomes and higher professionalism. But at the same time they should be analysed and revised because they depend on ideas of the development of professionalism and labour market demands.

The promotion of SDL in the situation of the Fourth Industrial Revolution can be carried out using:

- flexible group work learning environments in lecture-rooms and corridors promoting both formal and informal learning, and expressing of views;

- learning through Moodle environment, YouTube, blogs, video games;

- diversified education programmes considering labour market topicalities and involving practitioners in contact hours;
- teaching/learning methods focused on innovations and outcomes (knowledge, skills and competence) based learning.

4. Empirical study

The questionnaire of 305 first-year students took part in October and November 2018. Results are ranged considering the frequency of answers in the highest level (Table 2).

The first two question were about the students' purposefulness and motivation to reach better learning outcomes. Correspondingly 230 and 208 students assessed that indicator as high and 75 and 96 students – medium. Low assessments were not for those indicators except one student. The students comments were both motivation as necessity to get deeper knowledge and become a competent professional and stimuli as good work, free of charge studies, a scholarship. A part of students marked that they are purposeful only in individual courses.

Students marked mainly high and medium assessments also in the question about their responsibility towards learning (154 answers – high and 147 – medium and 4 - low). Many students recognised that they could be more responsible towards learning but there are such obstacles as laziness, many interesting outdoor activities and lack of motivation.

Table 2. First-year students' assessments of SDL.

No.	Indicator	Assessment grade			R_{high}	Σ_{1+2}	$R_{1+2\,\Sigma}$
		high	medium	low			
			R				
		1	2	3			
1.	Purposefulness to reach better learning outcomes	230	75	0	1	305	1
2.	Motivation for knowledge	208	96	1	2	304	2
3.	Responsible learning	154	147	4	4	301	3
4.	Implementation of effective learning strategies	92	198	15	5	290	5
5.	Control and assessment of learning progress	160	137	8	3	297	4
6.	Importance to express a view	88	171	46	6	259	7
7.	Time management to reach better learning outcomes	73	190	42	7	263	6

Students were asked about their skills to use learning strategies effectively. There the medium answers dominated (198 answers) and only 92 students assessed that indicator as high, and 15 said that learning skills are low. The students commented that they try to use and even investigate which learning strategies could be better for them and they recognise that they are successful. At the same time most of the students comment that they have adaptation and e-learning difficulties, they are quite chaotic and do not know how to learn more effectively.

Students positively relate to control and assessment of their learning progress and more than a half of students (160) mark high level of this indicator but there are also 137 answers for medium level and eight for low level. The students comment that they assess their progress or do it episodically. It is worth mentioning that the students are only at the beginning of their university learning but this indicator shows also their habits from the secondary education.

Expression of one's view and time management is a problem for many students with medium assessment dominance. The students answer that they are timid, critical towards themselves and do not feel competent to speak. It means that group work methods and problem-based learning have to be more expanded during contact hours and project works.

Time management problems solving can be solved educating students and academic staff both theoretically and practically including the themes in social courses.

5. Conclusions

SDL can be effective if it corresponds the indicators of professionalism and learning outcomes that is why labour market and professionalism traits should be followed up constantly. Learning outcomes and SDL should be revised regularly because they depend on ideas of the development of professionalism and labour market demands.

As SDL is a complicated process consisting of various indicators affecting factors should be analysed and assessed in further investigations. Purposefully managed self-directed university studies are highly important because they put a stress on each student's higher responsibility, initiative, motivation, independence, collaboration and self-assessment. Students control and assess their learning steps. Teachers should provide a high level lecturing and advising.

The questionnaire results serve as a means of revision of the students' and academic staff understanding of SDL. Continuous development and support of SDL components promote the quality of learning and understanding of the individual's human capital opportunities in the frame of competence oriented systemic studies.

Regular investigations of students' SDL help to assess which indicators should be improved and what teaching/learning aids to develop. Medium results dominate in relation to implement effective learning strategies, importance to express one's view and time management. It means that preferably an electronic aid on learning strategies for the first year students is necessary. The study results also indicate that more teaching methods promoting one's views expression are of high importance and should be more expanded in the further education courses for academic staff.

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Interdisciplinary Medical Communication Training at the University of Pécs

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Abstract

Medical communication training is being challenged to meet the demands of a more internationalized world. As a result, interdisciplinary simulation-based education is designed to advance clinical skill development, specifically in doctor-patient interactions. The Standardized Patient Program has been applied in American Medical Schools since the 1960s, implementing patient profiles based on authentic cases. At the University of Pécs, Medical School in Hungary, this model is being adapted to facilitate improving patient-interviewing, problem-solving, and medical reporting skills. The interdisciplinary program operates in Hungarian, German and English languages, utilizing actors to perform as simulated patients under the close observation of medical specialists and linguists.

This innovative course is designed to train students to successfully collect patient histories while navigating medical, linguistic, emotional, and socio-cultural complexities of patients. Experts in medicine and language assess student performance, offering feedback and providing individualized training that students might improve their professional and communicative competencies. This paper examines how this interdisciplinary course provides valuable opportunities for more efficient patient-oriented communication practices. Through responding to medical emergencies, miscommunications, and conflicts in a safe environment, medical students prepare to deal with a diverse patient context, that more qualified and empathetic health personnel may be employed throughout clinics worldwide.

Keywords: interdisciplinary simulation-based education; doctor-patient interaction; MediSkillsLab; medical history taking; language for specific purposes competencies.

1. Introduction

Simulation as a technique has been widely used in training, education and skill assessment since the early 1900s, initially in aeronautics and the war industry (Rosen, 2008). Employing simulation methods in medical education training has become increasingly popular in various healthcare contexts, involving the replication of real patients, anatomical regions and clinical duties in addition to performing lifelike situations in clinical environments (Issenberg & Scalese, 2008). The global prevalence of simulation in medical training may be attributed to several factors. One obvious factor is that rare or difficult clinical situations can be practiced in simulation exercises. Another factor may be the decreasing number of medical student-to-patient encounters in real clinical settings, an enormous obstacle in the training of future doctors. This may be explained by the fact that the number of medical students is growing while the time allocated to the clinical training of medical students is decreasing. Furthermore, the appearance of more modern diagnostic and therapeutic modalities increases distance between doctors and patients (Issenberg et al., 2008; Gaba, 2004; Weller et al., 2012; Ziv et al., 2000; Ziv et al., 2003). Accordingly, several viable methods were successfully adapted to practice clinical non-clinical situations. Simulation techniques include the standardized or simulated patient, anatomical models, various partial-exercise trainers (e.g. Pelvi-trainer), and computer-controlled human patient simulator models (Rosen, 2008; Issenberg, 2008).

A standardized patient can be defined a real medical patient which students can evaluate through analyzing health records, taking medical history and performing basic physical examinations as part of their medical training. A simulated patient is a healthy person who simulates a patient based on a case report (Beigzadeh et al., 2016). Employing standardized patients and simulated patients provides medical students with a unique learning opportunity while not endangering patient safety (Watson et al., 2002; Alinier, Hunt, & Gordon, 2004; Seropian et al., 2004). Simulation is a safe environment for practice with gradually increasing levels of difficulty and customized for the students' skills and is an alternative to the costly, potentially dangerous and unethical practice of practicing on patients (Issenberg, 2008; Gaba, 2004; Ziv et al., 2000; Ziv et al., 2003).

In the United States, actor-patients have been applied since the 1960s (Barrows & Abrahamson, 1964; Jason et al., 1971; Werner & Schneider, 1974). Initially, actors were trained for neurological patient examinations (Barrows & Abrahamson, 1964). Then more difficult situations (e.g., giving difficult diagnoses, providing information about the progression of a disease) were simulated to teach students how to conduct interviews with actor-patients. These first simulated programs were employed for pedagogical purposes, providing feedback for medical students. Later, other tasks were introduced, such as carrying out interviewing strategies applied during a complete history taking or physical examination of the patient. These simulated programs provided standardized education of students in

authentic settings (Boulet et al., 2003), resulting in far-reaching licensure of the method for exam purposes (Grand'Maison et al., 1997; Brailovsky & Grand'Maison, 2000). Despite these developments, participants in medical education all over the United States articulated their concerns in the late 1980s and the early 1990s regarding patient dissatisfaction with healthcare services. Major problems arose from negative doctor-patient interactions (Whelan et al., 2005), despite increasing technological achievements. Interpersonal aspects of the doctor-to-patient relationship proved to be critical (Hall et al., 1981;) over the course of their careers, clinicians take 100,000 - 200,000 medical histories (Keifenheim et al., 2015). Therefore, effective communication between patients and health personnel is of vital importance and medical communication training of future doctors is essential.

Renowned American medical training centers apply simulated educational programs (e.g., Clinical Performance Center at the University of Chicago, Morchand Center for Clinical Competence at the Mount Sinai School of Medicine, in New York,) and have been coordinating actor-patient trainings for decades. Similarly, simulation programs have been adapted in Germany at universities like Charité in Berlin or the Medical School in Giessen. Since 1999, about 130 standardized patients have been participating in the education at the Charité, one-third actors. There are 5500 occasions annually where actor-patients and medical students collaborate.

However, the methods of medical education in Hungary lag behind other countries. Prior to the initiative documented in this paper, no medical training centers incorporated simulated patient programs in their curriculum of graduate or postgraduate training. Interestingly, Béla Buda, the famous Hungarian psychiatrist, psychotherapist and writer of several medical communication books, urged the improvement of medical communication skills in 1986. Buda emphasized the necessity of developing empathy during medical education training and argued that understanding and perceiving major channels of verbal and non-verbal communication were essential (Buda, 1986). Moreover, Szili's work discusses the challenges of treating 'difficult' patients and the importance of employing the necessary politeness strategies in order to facilitate more accurate history taking and initiating closer cooperation between the participants of the interaction (Szili, 2007). Therefore, the program in Pécs has been designed to address these issues.

2. Objective

The course *Taking Medical History with Actors - Simulation Practices in the MediSkillsLab* was launched in Hungarian and German in 2016 and initiated in English in 2017. The course was designed to facilitate student improvement of efficient history taking skills. Compared to more traditional programs, this interdisciplinary course employed actor-patients in order to dynamically enhance students' professional medical communication skills.

3. Method

Years prior to the elaboration of patient profiles for the current project, an educational project *TANDEM – History Taking Groups* was launched, incorporating Hungarian and German students and senior tutors. This project sought to facilitate development of patient interviewing techniques through group tasks, motivating international and Hungarian students to support each other in their studies. Based on TANDEM, the bilingual *Pécs Model - Peer learning, peer tutoring* was initiated with more focus on medical communication skills and professional vocabulary (Koppán et al., 2015). Through these projects, various Hungarian and German patient profiles were collected, serving as a basis for the interdisciplinary medical communication training with simulated patients at our Medical School.

Prior to the launch of the current project, linguists, communication instructors, and clinicians collaborated to design education materials and patient profiles. Clinicians selected which authentic cases would be written and finalized as "roles" with regard to the genre of medical history and criteria of text structure. Roles were then transferred to actors for learning. Presentation of professionally authentic patient profiles embodied by actors is performed as a simulation of relevant clinical cases, and are controlled, moderated and narrated by clinicians and linguists.

3.1. Preparation of actors and cases for the simulation

Professional actors come from the National Theatre of Pécs (Hungarian) and the Deutche Bühne of Szekszárd (German). Amateur actors in the English course, a linguist and an artist, are American. And we do collaborate with a professional Hungarian actress who finished her acting studies, and played in Hollywood movies in the USA, then in the UK. Actors prepare for their roles by observing a real patient interview at the clinic carried out by a physician and standardized patient. During this phase, the actor becomes familiar with relevant questions and answers appropriate to the clinical case. Furthermore, the actor recognizes behavioural patterns characteristic of the given medical history (e.g., anxiety, pain-induced disability).

The next phase involves case interpretation with the clinician and the linguist. The actor learns the necessary tools to portray the character they have been assigned and become familiar with the patient's psychosomatic conditions, clinical features, characteristic complaints and behavioural patterns related to the disease or condition. The clinician explains the major symptoms, the process of diagnostic examinations including laboratory tests (e.g., blood, urine, stool) or imaging techniques (e.g. chest X-ray, cranial CT), and informs the actor of prognosis of basic medicinal therapies and surgical interventions.

In the third phase, the linguist and psychiatrist form a realistic patient history, including a family and social background, in order to enable the actor to identify with the patient in the case. The psychiatrist determines the cooperative (or uncooperative) nature of the patient, whether the patient is agreeable or agressive, what conditions the patient suffers from (e.g., depression, drug or alcohol abuse) (Cannarella Lorenzetti, Jacques, Donovan, Cottrell, & Buck, 2013) and how these traits and issues will affect the patient's attitudes during history taking. The linguist provides the minimally required language base and communication for all these considerations (e.g., medical condition, personality traits) and the case is sent back to the clinician for approval.

In the last preparation phase, the actor is sent the finalized case and learns the role.

3.2. Simulation Practice

Simulated cases are presented in an authentic setting, the MediSkillsLab at the University of Pécs, Medical School. The medical laboratory includes a patient's bed, examination table, and other required medical tools and equipments, designed to create a realistic environment. Our interdisciplinary practice enables students to initiate patient interviews and history taking in small groups as well as individually with the actor-patient, observed, evaluated and assessed by other student members of the group, the clinician and the linguist.

The simulated practice is divided into three parts. First, students practice taking patients' histories in groups or individually in structured patient-interviews. Afterward, students use the data they collected from the patient-actor to present the patient's case to the clinician within a specific timeframe. Thirdly, students receive feedback on their performance from three perspectives: professional/medical (from the clinician); linguistic and communicative (from the linguist); and patient (from the actor-patient.) Each training session includes two or three scenarios.

Medical histories taken from actor-patients are recorded (written and digitally) throughout the semester, thus students and instructors can closely monitor personal and teamwork development regarding professional language and communication skills.

4. Discussion

Historically, a central element of medical education has been observing clinicians treating and examining real patients. This task may be performed with a simulated patient, where medical students may gather life-like experiences, while improving their skills in a controlled and safe environment. Several studies confirm that both communication and practical skills may be acquired extensively by applying the program (Roter, Larson, Shinitzky, Chernoff, Serwent, Adamo, Wissow, 2004; Aamodt, Virtue, & Dobbie, 2006; Yedidia, Gillespie, Kachur, Schwartz, Ockene, Chepaitis, Snyder, Lazare, & Lipkin, 2003; Barrows, 1993).

Furthermore, students are provided opportunities to practice not only doctor-patient interactions, but also doctor-relative and doctor-doctor. Students receive feedback tailored to their performance to allow for development of interpersonal, professional and communicative competencies.

Our program aims to train students in employing politeness strategies and practice treating "difficult" patients; however, it should be emphasized, that our program is not intended to replace practicum courses at the patient's bedside at the clinic. Instead, we aim to prepare students for the practicum course through the simulation course *before* they reach a real medical facility.

The novelty of our interdisciplinary method included the involvement of a psychiatrist designing patient profiles and monitoring student performance which allowed the professional actor-patients to elicit authentic reactions from the students not necessarily confined to diagnosis. The psychiatrist provided feedback and controlled for proper medical behavior and reactions, thus ensuring that problem-solving skills in interpersonal conflicts develop adequately.

The high-tech components of the MediSkills Lab were essential to successful implementation of the simulation program. Recording classes provides invaluable opportunities for students and experts to observe student progression.

5. Conclusion

The present paper introduces the first adaptation of the simulated patient program with actor-patients in Hungarian, German and English programs in medical education in Hungary. Medical communication, taking medical history in particular, is one of the most important and frequent duties of clinicians. Our program aims to address this by facilitating development of medical communication language, doctor-to-patient, doctor-to-doctor, and doctor-to-relative interaction skills, and politeness strategies.

By introducing students to the medical environment in the earliest stages, we hope that providing context will better prepare them for their practicum courses, decreasing the burden on clinicians dealing with a growing number of students. Because international students are required to work with Hungarian patients in their practicum courses, Hungarian language instruction may be introduced in the simulation course.

The largest challenge of the simulation course is the complex procedure of creating real patient profiles; no patient is exactly alike, therefore it is important that doctor-patient interactions be different. Accordingly, student tasks should be similarly complex to create realistic contexts, and this can only be achieved through a bank of patient profiles for simulation.

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How to Teach Ecology to Students of Environmental Engineering

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Abstract

The paper illustrates a set of teaching practices applied by the author in the course of Ecology, addressed to third year students of the First Cycle Degree (BSc) in Environmental and Land Engineering, at the University of Trento (Italy). The features of the university context and the main characteristics of these students are described, also referring to changes which have occurred over time. On the basis of a twenty-five-year teaching experience, the author highlights the challenges and opportunities of an approach aimed at involving students in the learning process, raising interest and curiosity towards ecological issues, stimulating students' emotional competencies and their capacity to critically reflect on their own educational experience. In conclusion some comments are made regarding the need for a greater engagement by the academic staff towards non-conventional teaching and learning experiences. In particular, a more integrated method of evaluation of the quality of teaching is sought, effective in taking into account different approaches and techiniques and comparing learning outcomes.

Keywords: learning; participative approach; storytelling; fieldtrips; teamwork.

1. Introduction

Being effective, when teaching Ecology in a course of Environmental and Land Engineering, may be a real challenge. I immediately perceived it, when I first started teaching on this course at the University of Trento, coming from a background of Forestry Science studies and research in the early 90s. Since then, many things have changed: first and foremost the higher education system in Italy moved from five-year-degree courses to a three plus two years organization, following the Bologna process and, almost at the same time, each university was given more functional autonomy. Afterwards, various university reforms made by different successive governments generally exerted pressure for budget cuts and affected the university context resulting, among other things, in more compact courses, reduction of the time available for exams and of subjects to be chosen and generally less time available for personal study. Meanwhile, a clear institutional drive towards productivity and competitiveness in research have somehow "distracted" especially the young academic staff from teaching concerns. Following global socio-economic and cultural transformation, the characteristics of students have also radically changed (EU, 2011). Different cultures, languages, family environment and cognitive background shape today very heterogeneous groups of students. All the same, students seem to share a similar attitude in their approach to studying. A picture of Italian university students (Cattani, personal communication) depicts them as generally showing little propensity to delve into an issue and having a poor critical attitude towards problem solving. Despite having access to a multitude of data and information from multimedia sources, rather than being an opportunity, this often turns out to be a limitation. Moreover, the external context is full of stimuli and distractions and school and university are no longer considered the only source of knowledge.

Despite these changes, however, engineering students have over time retained some particular features, mostly linked to the *forma mentis* itself, which influenced their choice of the study course and, hopefully, of their future profession. They have a general inclination towards logical thinking and, being often gifted in maths, they feel much more comfortable when facing quantitative problems and numerical exercises than when they are requested to deal with qualitative issues and oral presentations. What they expect from their higher education is mainly to gain technical skills. This is also true with regard to environmental engineering students. Depending on the main focus of the study course, ecology is included in the curriculum of the different universities, with differing approaches. In some cases, ecology is mainly treated under a quantitative perspective for modelling purposes or, in other cases, points on chemistry related issues. Environmental engineering students at Trento university are supposed to work, in the future, in direct contact with the territory, in differents domains, from natural hazards management to water management, waste management, landscape conservation, renewable energies, cooperation

in developing countries and so on. Knowledge of ecological processes is therefore necessary and, for this reason, the teaching approach is basically qualitative, starting with some fundamental biological notions (often lacking in many students) and then deepening the concepts of structure and functions of ecosystems and their natural dynamics. All topics are addressed from the point of view of sustainability, trying to develop in the students a way of thinking that takes sustainability into account. Today, in the light of international scholars' analysis and debate, it is widely recognized that it is necessary to incorporate sustainability-related concepts and content into engineering education and the profession (Leal Filho et al., 2015). Obviously, this is particularly important when dealing with environmental engineering students. However, there is still a lack of knowledge about appropriate methods and tools and a need for information regarding the relationship between career success in engineering profession and wether there have been provisions for sustainability-related capabilities.

2. Teaching Ecology at the University of Trento

Ecology is taught as a compulsory subject in the third year of the First Cycle Degree, in the second semester. The course enrols about eighty students, with a slight majority of males (the percentage of males, however, has gone down over time, being around 90% in the early 90s). Exams are oral and critical analysis skills and capability of synthesis are required.

One of my first concerns is creating the conditions for an interactive, stimulating and, when possible, enjoyable lesson. Students are generally led to play a rather passive, often convenient role during the lessons and it is definitely hard to actively engage them in learning. Most of them have a well grounded theoretical background, but are not familiar with concrete, practical problems. Some of them approach Ecology with a kind of preconceived idea of an easy, "qualitative" subject, not requiring too much effort to prepare and with an exam not too difficult to pass whereas others have many expectations and are happy to be finally confronted with ecological issues, but think they do not have adequate skills to deal with such a study. In general, all of them are quite timid and hesitant when their opinion is requested and some of them do not even dare to ask for an explanation when there is something which is not clear. In such a situation it is dramatically important to stimulate from the beginning curiosity and interest towards the subject, which could hopefully turn into passion and enthusiasm, at least in the most sensitive students. Of primary importance is the need for helping these young people to develop their emotional competencies, according to Goleman's ideas (1995) and, among these, the ability to self-motivate, empathy, self-awareness, interpersonal effectiveness and communication skills. Building a strong tie with the "real world" outside the classroom and developing the capacity to deal with concrete environmental problems are crucial objectives of the course.

Acquiring and internalizing the specialist language of the discipline and creating bridges with other disciplinary contexts are other equally important aims. Finally, a meaningful learning in ecology involves overcoming the primacy of the Cartesian approach, typical of other subjects and implies a break with the traditional approaches, also in order to instill in students more responsibility for their own learning (Iori, 2010, Rogers & Freiberg, 1969).

For these aims, different activities are carried out throughout the semester, starting with an "ice breaking" workshop in the very first lesson. There are structured activities, such as practical exercises in workgroups or fieldtrips, which are carried out each year in particular parts of the course. There are then other practices I resort to when there is an opportunity and I think they may be helpful in keeping alive the students' motivation during the course. But it is also necessary to hold students' attention during the entire lesson (even a three-hour lesson!). With regard to this, many microactivities may, when necessary, help. Among these a simple change of setting inside the classroom or a short walk outside to do botany for real (a "hop" outside the classroom) may be effective. In the following subsections some of the main practices experimented during my work as a teacher are presented. Of course, depending on the case, each of them can help to achieve one or more of the abovementioned goals.

2.1. The "ice breaking" workshop

A question is written on the blackboard "What is the importance of being green in colour?" and students are invited to organize themselves in small groups. Each group is given a black marker and some cards of a certain shape and color. Specific indications and explanations are given only if expressly requested and students are left free to exchange ideas on the topic, discuss and finally summarise in a short sentence, on each card, each idea formulated by the group. Examples of possible ideas are: "Green coloured living things are important because they photosynthesise and therefore purify the air", "Plants are important sources of raw material" or "Green areas are relaxing and help mental health". At the end of this first step, a spokesman from each group is asked to attach the cards onto a specific section of the blackboard or the wall. Then, with a general discussion and the help of the spokesmen, the cards relating to the same or a similar theme are brought together (figure 1) and a logical title for these new sections is proposed (for example "Productive function of ecosystems" or "Recreation" and so on). This exercise, lasting a couple of hours, is useful both for students and for the teacher. For students it is a clear sign that their active participation in the lessons is welcome and it is a good aid to overcome shyness and get involved in dialogue with classmates. For the teacher the results are a thermometer of how the relative importance of the different goods and services furnished by the ecosystems has changed over time in the perception of young people. For example, a clear shift has been noticed from when students attributed the main importance to the protective and productive functions of forest ecosystems, as happened in the early 90s, to the present,

when they value much more the role of urban green for human well-being or they place emphasis on ethical issues. Moreover, the results give the teacher an idea of students' previous biological knowledge.

2.2. Practical exercises in the classroom

During the semester, practical exercises in the classroom are scheduled on different topics. Students are invited to work in small groups on the identification of the main local tree species, or for the realization of climatic diagrams. The botanical exercises are particularly loved by students, due to the fact that they are put in direct contact with the objects of their study. Even students who do not regularly attend classes do not want to miss this opportunity. In particular, the first botanical exercise, when students are faced with twigs without leaves, in winter *habitus*, is considered very satisfying, because it is experienced as a real challenge.

Figure 1. Students' ideas from the "ice breaking" workshop

2.3. Fieldtrips

The fieldtrips have always been considered the particularity of the course of Ecology at the University of Trento, and students ask right at the beginning of the course, if they will go on them and where. Half a day or the entire day is spent outdoors in different mountain areas of the province of Trento, often meeting technicians working in the territory, in order to discuss different topics: the management of natural resources, landscape conservation and soil protection. These activities produce many different positive outcomes: they put students in direct contact with concrete issues, thus opening new perspectives, they allow students to address different technicians operating in the field and to talk about environmental problems with them as peers, they facilitate the development of technical language and last, but not least, they foster the creation of a familiar, informal atmosphere, where any person feels free to express his or her personal opinion and to ask questions. Even if the fieldtrips take place mainly towards the end of the course, when the temptation to stay home to study for the exams is strong, the students generally participate in large numbers.

2.4. Inversion of roles

Students are asked, as a voluntary task, to prepare in teams a lesson on a specific theme, on the basis of material provided by the teacher and with the teacher's help if requested. They are free to organize the presentation in the way they deem the most convenient and, after that, time for a general discussion is allowed. Despite the fact that not all students are willing to launch into such a task, this exercise is however very helpful. In fact students find it much easier to discuss a topic with their peers and finally they have proof that, if their classmates can do it, then they can too and they may feel encouraged to try themselves next time.

2.5. Meetings with previous students

When it is possible, I organize meetings with previous students currently working in different fields and making use of ecological concepts and knowledge somehow. There may be people working for public bodies or freelance practitioners or researchers. They describe their activity in a few words and then answer students' questions, which are generally very numerous. In other cases students who are carrying out their master thesis on issues close to those of ecology come to talk about their work. Their presentation may constitute the development of a topic dealt with during a class.

2.6. Creating scenarios

This is an interesting task that all students have to fulfill at a specific point of the course, just before that part of the course which deals with the natural ecosystem dynamics. The idea is that, once provided with all the basic notions of ecology, students should be able to

resort to all their knowledge in order to hypothesize the possible natural ecosystem trends, starting from different initial situations, as suggested by the teacher. This work, generally considered quite difficult by students, requires a good effort in synthesising and, being carried out in small groups, stimulates the capacity for reflection and argumentation.

2.7. Storytelling

Since the beginning of my teaching experience, I have realized that a narrative style may be very helpful. Of course not all topics may be addressed with such an approach, but in many cases, transforming an explanation into a story may really make a difference. For example, the development of life on the planet may be a boring sequence of events or become the fascinating story of Life. In the same way, the structures and functions of trees may be just described by means of words and images or, putting students in the "shoes" of a tree, may be understood and appreciated as a revolutionary and smart way to be live beings. To appeal to people's emotions is not simply a means to stimulate curiosity and interest. Indeed, feelings and emotions are critical in the process of construction of knowledge and generation of individual authonomous thinking (Bruner, 1996; Dallari, 2012). Narrative thinking, though being creative, transversal and discontinuous, is at the basis of logical thinking, nevertheless (Smorti, 1994).

3. Conclusions

I am not a specialist in education and I do not carry out specific research regarding this. My experimentation in this field is mainly based on my previous personal experience as a forestry student (expecially with regard to practical exercises and fieldtrips) or is inspired by my research work on participative planning of natural resourses management. Finally, I have always had a personal aptitude towards the narrative style. For this reason I never thought of designing an experimental method in order to measure somehow the outcomes of my approach. Only recently I felt the need for starting to conceptualise it, deeming extremely important reflection on the effectiveness of teaching, especially in the scientific and technical domain. I have always looked for feedback, of course, but this was mainly based on students' direct appreciation, on their results at the exams, on the number of theses in ecology I was asked to be tutor for and finally on the requests of information and advice on the part of previous students. Unfortunately, until today, the need for an evaluation of didactic activities has been disregarded, especially at national level. This is also due to the fact that a succesful teaching activity is generally not taken into consideration in the process of evaluation of the members of academy, either at national or local level. But things are finally starting to change and a major awareness of the necessity of caring about didactic skills is now advancing, even at ministerial level. Actually, the University of Trento, since 1995, has been giving the students questionnaires, in order to evaluate the quality of the

different courses offered in some faculties. Today, such questionnaires have been standardized following the instructions of the Ministry of Education and are compulsory for all students. The problem is that such questionnaires have been designed with only the conventional approach in mind and the results are not particularly meaningful. However, things seem destined to change, starting from the local level. The University of Trento has made a Strategic Plan, aiming at more effective teaching (University of Trento 2018). Action 3 of such a plan fosters the experimentation of innovative teaching approaches. In this academic year (2018-2019), for the first time, a cycle of seminars on didactic skills, has been expressely created for young teachers, but it has also been attended by many older teachers. It has been a great success and people have largely taken the chance to finally meet, to compare ideas and discuss the topic. Eventually, such reflections seem to be starting to make inroads at national level too.

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EstuPlan: Methodology for the development of creativity in the resolution of scientific and social problems

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Abstract

Creative thinking is necessary to generate novel ideas and solve problems. "EstuPlan" is a methodology in which knowledge and creativity converge for the resolution of scientific problems with social projection. It is a training programme that integrates teachers, laboratory technicians and PhD students, master and undergraduate students which form working groups for the development of projects. Projects have a broad and essential scope and projection in terms of environmental problems, sustainable use of natural resources, food, health, biotechnology or biomedicine. The results show the success of this significant learning methodology using tools to develop creativity in responding to scientific and social demand for problem-solving to transfer academic knowledge to different professional environments. Bioplastics, Second Life of Coffee, LimBio, Algae oils, Ecomers, Caring for the life of your crop and Hate to Deforestate are currently being developed.

Keywords: Creativity; Problem solving; Entrepreneurship; EstuPlan.

1. Introduction

There are at least two different ways of thinking: (a) convergent thinking, which makes emphasis on replication of existing data and adaptation of known responses to new situations in a more or less logical way, and (b) divergent thinking, characterized by flexibility and originality in the production of new ideas. It is a fact that many essential attributes of creativity are not developed, or are lost, in the traditional master classes or exhibition, which is why it is important to create environments suitable for the development of creativity, environments that seek to generate relevant ideas and unusual that bring new visions that change the focus of the problems or redefine the problems to provide innovative visions and therefore solutions.

There seems to be a certain consensus on defining creativity as the ability to produce novel ideas and/or products and useful or appropriate (Amabile and Kramer, 2011). Originality and usefulness are the two criteria that are considered essential for "something", idea or product to be considered creative (Runco and Jaeger, 2012).

Creative thinking presents four characteristic traits that are measured: 1. Fluidity: to produce a large number of ideas; their measurement is made considering the total number of "relevant" responses. 2. Flexibility: to produce very varied answers belonging to different fields; the number of different categories of answers is measured. 3. Originality: to produce ideas far from the obvious and established; it is measured according to the curiosity of the answers. 4. Elaboration: aptitude to develop, enlarge and embellish ideas; the measure will depend on the number of additional details used. Therefore, in order to produce original ideas, it is useful to generate many ideas (fluidity) and different types of ideas (flexibility) because this increases the likelihood that original ideas will be generated being able to measure divergent thinking skills, fluency, flexibility original ideas, being able to measure divergent thinking skills, fluency, flexibility and originality.

Creative thinking can be considered one of the key competences with widespread effects in the 21st century. It is what has made it possible to fly to the moon, create art, develop computers or cure diseases. Creativity is not only recognized in sciences and arts, but has also been shown to play an important role in the resolution of everyday and extraordinary problems. In addition to its function in solving problems, creativity allows to be flexible; cognitive flexibility provides the ability to cope with the opportunities and changes that are part of our complex world undergoing rapid change. Creativity is found in the agendas of the business leaders and policy-makers throughout the world. For example, 2009 was declared the Year of Creativity and Innovation in order to facilitate the ability to think creatively across the population (European Commission 2008). The creativity is a skill that

must be developed in all disciplines and in all intellectual, scientific and social fields (Kampilis and Berki, 2014).

2. EstuPlan: Objectives and Value Proposition

EstuPlan is an original project of innovation and improvement of the quality of teaching developed by an interdisciplinary group that includes among its members teachers, administration and services technical staff and PhD and master students of the Complutense University of Madrid. It consists of the development of projects by undergraduate students, projects in which knowledge and creativity converge in the resolution of scientific problems with social projection and related to the use of natural resources. On the other hand, EstuPlan proposes a new system for the training of students in which teachers, laboratory technicians, PhD, master and undergraduate students are organized in work groups (Fig. 1).
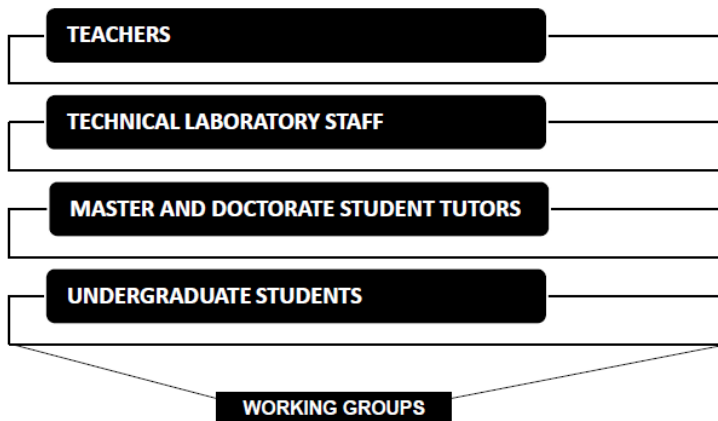
Figure 1. Actors in EstuPlan

Teachers, laboratory technicians and "older" students (PhD and Master) advise and help "younger" students of 3rd Grade for the definition and selection of problems, the search and definition of solutions, the genesis of ideas derived from the problem-solution binomial, and finally the elaboration of a project. It presents an innovative and useful methodology in the framework of today's society, the world of work, and in the context of entrepreneurship, areas that demand problem-solving skills and creativity to transfer academic knowledge to new application environments. EstuPlan is basic training and learning to transfer science and put scientific solutions at the service of society. It is the social projection of science. It

is a call and a new offer to universitary students. It is transferable to any field of knowledge.

The general objectives of EstuPlan are defined in the following terms:

1. To stimulate and develop the potential and creative attitudes of university students taking into account the dimensions of originality, fluidity, flexibility and elaboration that characterize creativity.

2. Applying knowledge to problem solving in new or unfamiliar environments within broader contexts of innovation, genesis and development of ideas.

3. Integrate and project specific knowledge in broader and innovative contexts.

The concrete objectives that help to achieve the general objectives are defined in the following terms:

4. To apply different methods to generate new ideas, or restructure existing ideas, and create novel alternative solutions to problems related to the sustainable use of natural resources.

5. To carry out a project.

6. To work collaboratively in multidisciplinary working groups.

7. To incorporate this activity into the training activities of PhD students.

Regarding the value proposition, EstuPlan responds to needs detected in undergraduate students such as:

a. To focus on problems, in this case of a scientific nature and with social relevance.

b. To solve problems in a significant way based on knowledge.

c. To give relevance to their studies and especially to their projection, and to them as students, in very close times and professional environments.

d. To take the decisive step from "knowing" to "doing".

On the other hand, EstuPlan is an extraordinary opportunity to integrate in the studies of degree methodologies and tools in line with current academic and profession. Therefore, it can be said that EstuPlan is a response to the above needs by providing a new environment because the working groups it proposes contain students, student tutors, technicians, and teachers who organize and guide the meetings and projects development (Fig. 2).
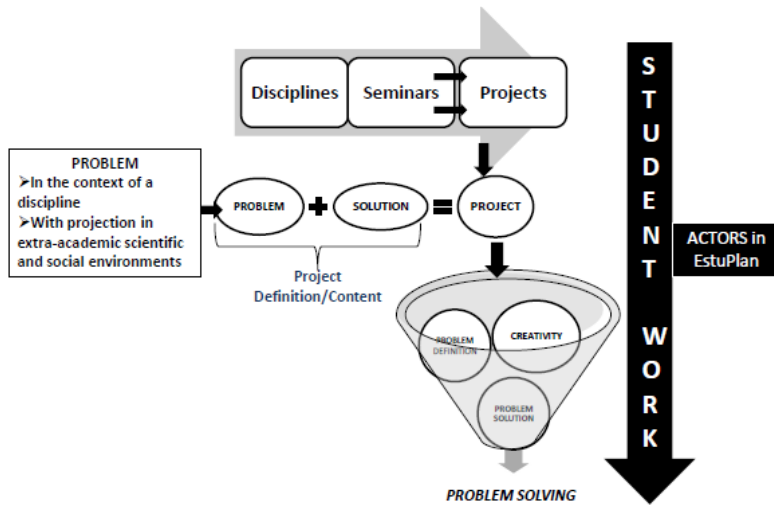
Figure 2. EstuPlan Goals

3. Methodology and work planning

EstuPlan follows a methodology that promotes creative output by providing training, techniques, media and exercises to promote creativity and the ability to problem solving. Use the SCAMPER tool, a thinking method directed towards an object, idea, event, situation or problem based on the brainstorming technique and developed by Eberle (2008). Each step of this method is directed by questions that represent the stimulus that leads to effective thinking (Buser et al., 2011). SCAMPER is the acronym for S= substitute, C= Combine, A= Adapt, M= Modify, P= Swap, E= Delete and R= Reorder. SCAMPER is a tool that allows this, promotes and activates creativity and skills to solve problems. At SCAMPER all questions are valid and all ideas should be considered.

EstuPlan is developed in one academic year and in two phases. Phase 1 consists of organizing the course and integrating EstuPlan into an academic discipline by proposing topics or problems related to that discipline. Phase 2 consists of three steps: step 1 of formation of the working groups, presentation of the members, project and the work plan; step 2 of development of the work plan by scheduling the face-to-face and online meetings; step 3 final of the project in which an infographics and a video of the project is made and a day of public exposition is established (Fig. 3). The final project in the form of infographics contains the following items: 1. Title, 2. Justification: description of the problem and proposed solution, 3. Project Structure: recipients, value proposition, media and/or necessary resources, 4. Relevance, scientific and social projection of the project.
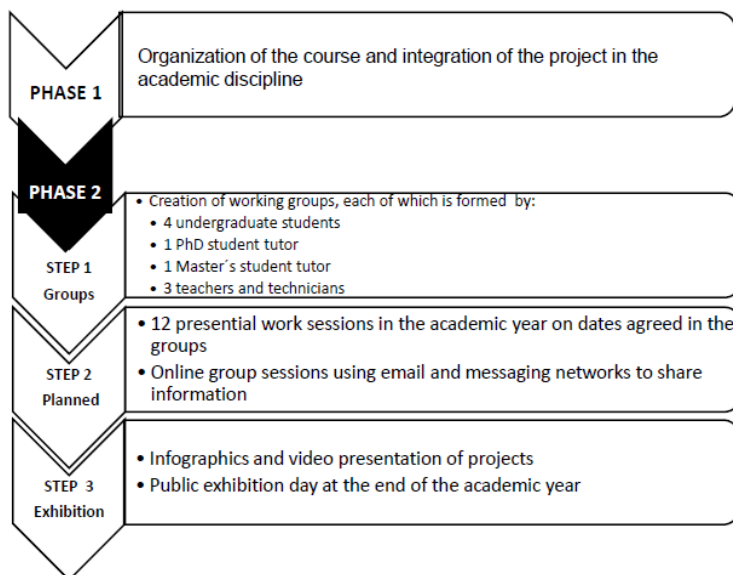
Figure 3. Work Plan

4. Results, Impact and Indicators

EstuPlan is a proposal of methodology and innovative tools in the context of Bachelor studies to develop creativity and the ability to solve problems in any field of knowledge. In particular and as example, this project is developed in the scientific field of Plant Physiology applied to environmental problems, the uses and applications of plant resources in different industries (Bioenergy, Biomedicine, etc.) and the use of agro-food waste. The following projects are currently under development: *Bioplastics, Second Life of Coffee, LimBio, Algae oils, Ecomers, Caring for the life of your crop* and *Hate to Deforestate*.

The results obtained are relevant in terms of creativity and development of novel and innovative projects, some of which have been recognized and awarded in competitions for ideas, project development and entrepreneurship such as Explorer-Complutense University of Madrid Space (https://explorerbyx.org/) or Compluemprende (https://www.ucm.es/compluemprende/)

Indicators to measure the impact in relation to the objectives are as follows: 1. Follow-up of the work plan: attendance at scheduled sessions and development of the meetings, activities agreed and committed, and on time; 2. Degree of satisfaction of the undergraduate students measured through a questionnaire with scale 1-5, on (a) information received about and participation in EstuPlan, (b) accessibility to the teachers, technicians and student tutors, c) degree of coordination and guidance received, d) orientation and projection of the work

carried out in Estuplan in other innovation environments and/or entrepreneurship, e) global assessment; 3. Degree of satisfaction of the teachers, technicians and student tutors, suggestions and proposals of improvement to expand its implementation.

5. Conclusions

Problem focus, creativity, problem solving and innovation are necessary and applicable skills in scientific and social environments, considering also that scientific problems have an enormous impact, involvement and social projection.

Consequently, EstuPlan can be developed in any subject or with students of any field of knowledge, either from Experimental Sciences, Health Sciences or Humanities. It is also interesting to extend EstuPlan to other non-university educational levels by adapting the contents.

Finally, EstuPlan's activities and methodology are also the seed of the entrepreneurship.

Acknowledgements

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Approaches to promote self-directed learning in Software Engineering

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Abstract

Software Engineering is a profession which requires expertise, but also underlies fast changes of contents and requirements. To cope with these challenges students in this subject need self-directed learning competencies. This paper explores Just-in-Time Teaching as one exemplary teaching method known to support self-directed learning processes. The focus in this analysis lies on a didactical evaluation of the sensitive use of this method concerning the special target group of software engineering students, the teaching content and material. The aim is to avoid a mere transfer of didactical approaches to students without additional value for the learners. Additional didactical consideration are directed towards (already existing) learning strategies of the students, which are essential for enabling students to efficiently benefit from self-directed learning arrangements. Resulting issues need to be evaluated through a serious data collection and analysis, which will be carried out in the subject of software engineering.

Keywords: Self-directed learning; software engineering; learning strategies.

1. Introduction

Software engineering is a profession, which requires expertise, but this alone is not sufficient for the fulfillment of the entire range of tasks. Work processes of highly complex disciplines are not sufficiently standardized and are marked by a high degree of variability. This leads to low planning security and constantly developing goals. Multidisciplinary skills and the ability to acquire new knowledge and skills are necessary to meet the requirements of this professional field. Therefore, teaching in the academic training of software engineering must help students to develop skills and abilities that enable the independent acquisition of knowledge, as the permanent changes lead to continuous learning requirements that software engineers even after completing their study phase have to meet on their own. Until a few years ago, academic training in software engineering was characterized by the mere imparting of expertise. But lately there is an educational change of perspective that focuses on the self-management of students' learning processes. The mere transfer of knowledge only partially meets the requirements for the competence profile to be developed in software engineering. Learning should rather be an active process of confrontation between individuals and their (work-) life, in which knowledge and competencies are actively constructed. For this reason teachers should pursue an enabling didactics that initiates and enables self-directed learning processes (Arnold, 2010).

This paper deals with teaching methods that are perceived as supportive for self-directed learning processes. Nevertheless, this perception needs to be substantiated systematically. In particular, sound evidence is needed if they are actually suitable for all groups of students and if the learners always have the right strategies to deal with self-directed learning. Since the last questions might turn out to be false, there should be a deeper analysis of the teaching methods and conditions, in which self-directed learning processes could be promoted efficiently. The main contribution of this paper is to pinpoint some core aspects that need to be examined in such an analysis. Since so far there is no clear definition of what constitutes self-directed learning, a definition is first made and the requirements necessary for self-directed learning processes are presented.

2. Self-directed

When dealing with the topic of self-directed learning processes, one encounters a variety of word combinations with the prefix "self-" such as self-organized, self-regulated or self-active learning. There are several attempts at definition and differentiation (Gnahs, 2002), but for all the disagreement and blurring of the definition, there seems to be at least the largely common view that there is never fully self-determined or completely other-driven learning, but merely "[…] a continuum between two extreme poles that do not occur in reality […]" (Gnahs & Seidel, 2002). According to Gnahs and Seidel, different courses move between the

two extreme poles mentioned (self-determined and other driven learning) and can be assigned on the basis of several aspects related to learning arrangements. There is also a noted development from knowledge transfer didactic towards a didactic of self-directed acquisition of knowledge and competencies. These approaches to a "new learning culture" (Siebert, 2006) are based on a constructivist didactic, which assumes that each person constructs its own reality and consequently generates new knowledge by linking it with previous experience (Siebert, 1998). The direct transfer of knowledge by the teacher to the learners is thus not possible in a linear way (Arnold, 1993). This means that the teacher methodically prepares content and information as part of enabling didactics in such a way that the learners take on more and more of the active part in the teaching-learning-process. A change in roles respectively a "shift from teaching to learning" must take place, moving away from simply imparting knowledge towards the design of subject-oriented learning opportunities and the accompaniment of learning processes (Knight & Wood, 2005). In view of the multitude of heterogeneous definitions of concepts, the article aims to use the term and concept of self- directed learning as a process of active self-development of knowledge and competence by the learner with the help of differentiated reflection processes and the facilitation of learner- centric courses by the teachers

3. Requirements of self-directed learning

The process of learning encompasses a transformation of already existing knowledge to expanded knowledge or new skills. This transformation requires cognitive abilities enabling the absorption and processing of information through social and individual processes. Learners must be able to critically review their knowledge assets and competencies with regard to their learning goals in order to determine the starting point of their necessary learning act in a first step (Konrad & Traub, 2013). This process, in which new informations or abilities must be linked to existing ones, can be supported by learning strategies that require an active use of the new and a reduction to its essential content. Mastering metacognition is important for the successful use of these learning strategies. This involves reflexively dealing with one's own knowledge and competency base and the strategies for deriving necessary learning steps, defining learning goals and paths of action (Konrad & Traub, 2013). In addition to learning strategies, motivation should be regarded as a sufficient condition for knowledge acquisition and as important as cognitive abilities. Cognitive learning strategies are first of all a collection of possible approaches, but motivational circumstances determine whether they are applied (Friedrich, 2000). The motivational conditions are distinguished in personal factors and in conditions that are located in the learning situation and can be motivated both extrinsic and intrinsic. For self-directed learning, the intrinsic motivation expresses in a positive, learning-related self-efficacy conviction with volitional strategies is particularly relevant. In this context, Deci and Ryan define three

criteria that influences intrinsic motivation. Felt competence/effectiveness, perceived autonomy/self-determination and perceived social involvement significantly promote intrinsically motivated self-directed learning (Deci & Ryan, 1993). Perceived competence/effectiveness depends e.g. on the right level of structure, suitable work material tailored to students and experiences of success, which can be seen in positive feedback. Transparent communication of the learning goals and a classification of the learning content in the overall context of the course also have a positive effect on the perceived self-efficacy of the students. Social involvement of students is achieved if, e.g. they can actively participate in a course and if there is an open learning atmosphere (Meissner & Stenger, 2014).

4. Self-directed learning with Just-in-Time Teaching (JiTT)

To gain skills in the area of self-directed acquisition of knowledge, teaching methods such as Just-in-Time Teaching (JiTT), Flipped Classroom or the Inverted Classroom Method (ICM)[1] seem suitable, because they are seen as to be supportive for the development of these skills. This paper analyzes JiTT as a representative example from this group of methods which are all known to support self-directed learning processes.

4.1. Just-in-Time Teaching

JiTT was first introduced in the 1990s and it was developed in the following years as a teaching learning concept used primarily in STEM (= science, technology, engineering and mathematics) subjects (Novak & Patterson, 1998). Meanwhile, JiTT is used in various disciplines and subjects (Simkins, 2010), but only recently in the field of computer science (Kamph et al., 2013). Originally created with the intention of increasing students' commitment to their field of study, JiTT should give students the opportunity to learn flexibly and efficiently and to train multiple skills such as the ability to acquire knowledge in a self-determined manner, collegial cooperation and communication skills. To achieve temporal flexibility students are provided online materials in the form of reading tasks, learning videos etc. before the next session. The course instructor then corrects the tasks "just in time", evaluates the solutions and incorporates the results of this evaluation into the next course session. The teacher provides feedback on how to solve individual tasks, reflects overall impressions of students' understanding of these tasks, and may address specific problems or questions. This type of teaching design offers teachers the opportunity to get a regular impression of the level of knowledge and understanding of students regarding the current topic. So in the upcoming course teachers can either repeat difficult topics more deeply or

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[1] Since Flipped Classroom and Inverted Classroom are used synonymously, in the remaining part of this paper only the term ICM (Inverted Classroom Method) will be used, concerning both terms.

conclude them relatively quickly if the majority of students have no problems with it. For students there are various advantages for their learning habits and the atmosphere in the course: On the one hand students become more familiar with the independent development of new knowledge through the preparatory texts and accompanying tasks, while at the same time learn to organize their time (Hagel et al., 2013; Novak & Patterson, 1998). In addition, the participants feel perceived by the teachers through the regular feedback and can better assess their respective levels of knowledge. They also take joint responsibility for the course, as their practice tasks serve as the basis for the upcoming course session (Simkins, 2010).

5. Reflections on the use of JiTT in software engineering

5.1. The need for self-directed learning in software engineering

In order to a better understanding of the need for self-directed learning in academic training in software engineering education, it is necessary to look at requirements of this field of work: the development of software systems requires many complex and independently executed steps. Customer requirements must be collected in multidisciplinary communication processes, documented in an appropriate form and implemented. It is important to constantly adapt to the requirements of the professional environment and to act appropriately in it. So flexibility, open-mindness and the ability to constantly explore new domains is necessary and only manageable with self-directed learning competency. In recent years the focus in software engineering education has been increasingly on activating teaching methods, which can support self-directed learning processes. This corresponds to the previously mentioned recognition that software engineering is a very complex field of work and its knowledge base is undergoing constant renewals. These characteristics make self-directed learning processes all the more important. It is fair to assume that methods from the blended learning field which use accompanying digital media, could work as a "door opener" for students in a technical subjects such as software engineering to get their attention and implicitly support their self-directed learning abilities.

5.2. Preconditions to a reasonable implementation of JiTT

Despite all interest in JiTT in recent years, this method must not be adopted and transferred to courses with the intention of making teaching more active and learning processes more self-directed without giving it a deeper thought. Learning objectives must be determined beforehand to characterize precisely what shall be learned in the course, before the question of how the content should be provided can be addressed. The following factors must be taken into account in the didactic design of self-learning environments (Jenert & Zellweger Moser, 2011): Students must already have sufficient learning strategies, e.g. the ability to structure their time or the ability to prioritize the contents that have to be learned. Equally important

is the ability to perceive, assess and, if necessary, correct one's own learning activities and processes in a reflective manner (Jenert & Zellweger Moser, 2011).

These skills cannot be assumed as granted. The two teaching-learning-methods described above do not explain strategies of self-directed learning, but give students the opportunity and the freedom to self- directed learning. This means that without further guidance or prior consideration of the target group for this teaching-learning-method, there is a risk that students will be overstrained. Furthermore, the motivation of the students is relevant, which must not be out of focus, since especially in self-directed learning processes the intrinsic motivation is decisive for the learning success. In addition students should be given enough space for exchange and interaction, since "learning in the constructivist sense is understood as a social process." (Jenert & Zellweger Moser, 2011).

6. Studies on the effect of JiTT in software engineering training

In relation to the teaching method presented, an analysis is currently being carried out at the University of Applied Sciences and Art Coburg on the use of the methods and their didactic background. For several years now, a course in requirements engineering has been offered here, using JiTT. In another basic course ICM is implemented in the form of learning videos provided to students on the Moodle platform. In the university context, there are already some multidisciplinary studies dealing with the use of JiTT and the impact on student satisfaction with the course and how helpful students assess the method in terms of their own learning behavior and a possible improvement in their academic achievements (Meissner & Stenger, 2014). Some studies focus on the teachers' perspective on the use of JiTT and, e.g. on the amount of work done by lecturers (Gavrin, 2006). But are evaluations that focus on the question of students' satisfaction with a certain teaching method or how much work load this method imposes on a lecturer enough for a deep pedagogical-didactical understanding of these methods and their, arguably, positive effect on students learning strategies? So far, there are no studies in software engineering on the question, which aspects of already existing learning behaviour or knowledge acquisition strategies of the student have an impact on the use of these teaching methods and the quality of these effects. The basic research already mentioned examines the framing conditions for the use of JiTT in connection with learning and teaching software engineering. In this context, questions relating to the value of JiTT for learning success and the improvement of teaching in software engineering will as well be examined as the aspect, under which these didactical methods are especially suitable for certain courses and groups, for certain topics and material. Without this reflection on the motives and effectiveness in the use of JiTT or other blended learning methods, these methods could be simplified into a purely methodological instrument that can be used without appropriate suitability for the respective event and group of students and so quickly could lose their real effectiveness.

7. Conclusion and outlook

Changes in social and economic structures are leading to new forms of learning and working, which requires the individuals`s ability to reflect, acquire and develop knowledge. These self-directed learning processes can be supported by certain teaching methods such as JiTT, as they offer students the possibility of independent time structuring, a selection of suitable learning materials and an exchange with other learners in the courses. Still, it needs to be asked if JiTT and other blended learning methods do really support self-directed learning processes, if this support works for all groups of students, for all courses, for all teaching contents, and if students are already in command of learning strategies that enable them to benefit from self-directed learning arrangements. Against the background of the didactic considerations presented, it is important to repeat that while there are many points of reference between the constructivist approach of pedagogical discipline and self-directed learning arrangements in software engineering, in terms of the discipline of software engineering these need to be adapted to the respective factors of the field and the target group. In order to achieve added value for students in software engineering training at universities and to avoid a mere transfer of didactic approaches to this specific target group there will be a quantitative and qualitative data collection among different courses using JiTT or related teaching methods in software engineering education. This study aims to didactically contribute to the targeted promotion of self-directed learning in software engineering, which will enable students to meet a world of permanent changing challenges with the help of self-directed learning.

Acknowledgment

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Globalizing curriculum beyond the classroom: Service Learning Programs benefit Students, impact local issues and answer local needs to build bridges between cultures

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Abstract

Based on a case study, this article analyzes the effects of introducing Service Learning in the curriculum of a study abroad US Center. Explaining institutional motivations as well as resistances, this research shows that this introduction was essentially academic in nature, and represented an innovative way to some perceived deficiencies in the acquisition of learning objectives by students. This research also indicates the specific conditions in which this type of Service Learning can thrive, such as a strong welfare state context, which is both a support and a potential issue, and the necessity to have students supervised in their service by local managers. More general lessons are drawn for a successful practice of Service Learning abroad: clearly defined academic goals, strict distinction between Service Learning and other forms of volunteering or experiential learning, ethical rules to prevent patronizing attitudes among volunteers.

Keywords: Service Learning;curriculum; innovation.

1. Introduction

This article analyzes how Service Learning (SL) contributes to the formal acquisition of learning objectives in the context of a sociology course delivered at a European Center. We will emphasize the necessity to envisage SL from a curricular standpoint, thus differentiating this type of community-based learning experience from co- or extra-curricular forms of engagement in the local community. Ultimately, we will show how SL can creatively transform and enhance the development of a curriculum abroad.

We will follow a case study methodology, regarding the European Center as a whole as an "integrated system" and the Sociology course in which SL takes place as a subsystem, or "working part" to use Yazan's terminology in his survey of case study methodology (Yazan, 2015). In this institutional approach, where the institution is recognized as a "structuring base" (Di Maggio & Powell, 1997) we use the institutional memory as shared/lived by actors to provide structured comprehension of the case and we will use assessment questionnaires to consider the impact on learning process as an empirical basis for the analysis.

We will be presenting briefly the tenets of SL as understood in the US., before analyzing how they have been implemented in the case at hand, before reflecting on students' learning outcomes. We will not shy from pointing out some limitations in the approach, nonetheless underlining its overwhelming benefits.

2. What are Service Learning and International Service Learning?

SL is a feature of US. higher education which is relatively uncommon in the European landscape of universities. It is "a course-based, credit-bearing educational experience in which students (a) participate in an organized service activity that meets identified community needs and (b) reflect on the service activity in such a way as to gain further understanding of course content, a broader appreciation of the discipline, and an enhanced sense of civic responsibility." (Bringle & Hatcher, 1995).

Quite unanimously, the idea of making students actors of their own learning is attributed to John Dewey (Eyler & Giles, 1994; Pacho, 2015). The idea was reinforced in the 1980s, with David Kolb, who developed his "Experiential Model Learning" (Kolb, 1984) based on Dewey's work. Such considerations meshed with first attempts of direct learning in the U.S. from the beginning of the 20th century (mostly on an agricultural basis and during the Great Depression), and the impact of Civil Rights movements while civic organizations such as Peace Corps and VISTA emerged. (Flecky & Gitlow, 2011). Hence a political tone to SL that is still present nowadays (Mitchell, 2007) despite growing concerns that "rhetoric may be winning over reality" (Butin, 2006).

International Service Learning (ISL), or Global Service Learning (GSL), is the implementation of SL in the context of a study abroad program, *i.e.* outside of the home country of the institution to which the students participating in the course belong: "ISL (…) can be conceptualized as the intersection of three different educational domains: (a) service learning, (b) study abroad, and (c) international education."(Bringle, Hatcher, & Jones, 2010)

3. The case: from resistance to involvement of stakeholders

The case we study is the one of a long-established (over 50 years) European Center from Miami University, a public Midwestern university. This European Center abroad is the only permanent location of this university outside of the US. even if the university offers many study abroad opportunities to its students, consistently ranking among the top 5 US public universities as regards to study abroad. The teaching language is English and students are not required to be proficient in any of the local languages (Luxembourg has 3 official languages). Academic regulations and accreditation rules are the one of the US. home campus.

The home university in the US. is known for its long tradition of service, having been named to the [US] President's Higher Education Community Service Honor Roll from 2007-2015, and winning in 2012 the Presidential Award.

Consistent with this tradition and general know-how, the university's Center abroad is characterized by large offerings in the field of "out-of-class" learning activities spanning from study tours and field trips, to independents studies, many of them in the context of service to the local community, volunteering, and internships. SL, implemented in 2014, is the latest addition to this already large range of offerings.

The development of SL corresponded to the preoccupation of stakeholders who felt that current students were not really or sufficiently immersed in the community and stayed in their "bubble" (a term often used at the time). Those stakeholders were: a/ the advising Committee in the US. b/ alumns of the program and c/ local (Luxembourgish) alumns.

For the leadership of the European Center abroad, this general preoccupation had more narrow educational and academic. The lack of integration of students weakened their ability to reach the Learning Objective of the Center to "develop and exercise the ability to communicate and act respectfully across linguistic and cultural differences". SL was perceived as a way to bring rigor in the experience of students by enhancing their reflection as regards to their context thanks to the academic part of SL. This analysis was not unanimously shared, and some significant resistance had to be overcome, before SL was tied to a sociology course, "Aspects of European cultures" which carries 4 credits (3 in-class, 1 SL). Evolving from a short 7-week program in 2014, SL is now part of the regular semester offerings.

4. SL Learning Objectives and Service

The Learning Objectives of the sociology course are delineated in three main rubriques: 1/ Welfare state ("take an in-depth look at the nature and practice of social welfare institutions in a wealthy country, and the challenges faced due to rapid urban population growth and economic development") 2/ Equity ("critically engage students in asking questions of "why".) 3/ Education ("understand how a country manages to integrate a massive foreign population and give equal opportunities").

The service part of the course consists in a weekly community service for a minimum amount of 20 hours—usually more. Community-based service activities are combined with in-class learning activities and student reflection: students provide service in their community that is directly connected to their academic coursework and the community provides an educational experience for the student.

5. A specific program: learning/teaching French with refugees

One program has to be set apart as a radical innovation which has, to our knowledge, no equivalent: it is the opportunity offered to American students to co-teach French to migrants learners through a communicative approach method. This makes the experience unique in the sense that students teach a language they are themselves learning, which disrupts the dominant paradigm of "teacher as authority"(Portes & Smagorinsky, 2010). In the situation of students teaching refugees, which they do under the supervision of a qualified French teacher, they also learn from others, as they develop linguistic skills and interact over the material taught. Beyond enhancing their practice of French, students learn from students/migrants' experience.

A first iteration of this program also included the development of a nursery for the children of the refugees coming to campus for their lessons. The nursery was organized by students, some of whom specializing in early childhood education.

6. Ethics of ISL

Theoretically, ISL/GSL should follow the same guidelines as SL. It particular, it must abide by the strict connection between learning objectives in a class and service activities outside of the classroom. However, a quick survey of many programs labelled as "International Service Learning" abroad reveals significantly different scopes. ISL for instance advertises "Travel and volunteering" and Global vision puts forward its "25,000 travelers" for their "Service Learning" programs. Traveling and volunteering are emphasized rather than a specific credit-carrying, fully embedded experience.

In reaction to this loosened approach of SL, a few principles were laid to keep the academic rigor of the program.

1/ **SL strictly complies with its academic and curricular definition**: offerings are clearly distinguished between what *is* and *what is not* SL. Volunteering opportunities, internships are also available to students, but the crucial difference is the embedment of service activities in a formal course approved by the authorities of the university in the US.

2/ **SL is separated from "travel" experiences.** Even though travels are considered and advertised as a desirable part of the experience of students abroad, they are recognized as different. The "travel" experience is meant to give an appreciation for differences and situations which will stay foreign to the travelers. Quite the opposite the goal of SL is to embed students in their local community, by developing personal links with it.

This difference does not necessarily entail a hierarchy. Both the development of a sense of belonging in the community through service *and* discovery in an outsider's position through travels are favored by the program. They are nonetheless kept separate as different goals to reach differently the Learning Objectives of the program in general.

3/ **SL's organization avoids patronizing attitudes**: While most volunteers have a genuine interest in helping others, their service can at the same time be seen as condescending or patronizing and akin to a "missionary attitude" (Weah, Simmons, & Hall, 2000). This dimension is unconsciously embedded in the advertising material of many providers of ISL/GSL: brochures feature students usually white teaching or playing with people who are mostly Asian or African, often shown in their traditional outfit. It is an interesting display of striking cultural differences, but also a disturbing illustration of an exotic conception of the others, which is somewhat disheartening after decades of critical postcolonial studies.

SL in the case at hand avoids this potential slip into patronizing attitudes for structural and organizational reasons. In terms of organization, the academic supervisor is the SL coordinator of the university's Center abroad, but a local supervisor assigns tasks to the students. Students are thus embedded in the "chain of command" of the local structure. In terms of structures, students are volunteers in a Western European one of the highest GDP per capita country with a highly developed welfare state—superior in many regards to the US. situation.

As a side consideration, we can note that this situation constituted a challenge, and even a sort of "reversed challenge" for the SL coordinator: when state support is reasonably abundant, how can one entice partners in the community partners to collaborate with the university in terms of delivering content, guiding and managing students and act as teachers in the Service-Learning process?

It is not necessary here to delineate the detail of the incentives which engage community partners in a SL project. Let us simply note they range from organizational requirements of developing operating ties with external organizations to the most and simplest humane curiosity for foreign youth. Beyond incentives, the arch-reason for having volunteers is that "there is no human community that is without needs or problems."(McLeod, 2017) and therefore that there is always a demand for the original types of support that volunteers can provide. Even in a wealthy nation with a well-developed and funded welfare state, there are people left behind by poverty, urbanization, and a lack of proper education. This was aptly summarized by a student participating in SL: "I thought Luxembourg was a very rich country and it was jarring to know how many people need help".

7. Student impact

Each semester students fill a questionnaire as part of their formal assessment. The analysis of the questionnaires shows that the objective of better integrating students in the community is met. "My service learning gave me the most realistic view of European life in Luxembourg. Deeper appreciation for the culture here was developed." "This project made me realize that there are many people in the Luxembourg community that care about the well-being of other people." "I have gotten to understand more about the culture of Luxembourg, as well as make connections with many students." "I was able to interact with other Luxembourgish students and adults from very different cultures than my own". The experience of SL as a formal learning experience is also well understood: "I learned a lot about the welfare system in Luxembourg and how many people are affected by poverty in the community". This formalization is sometimes tied to a specific academic input: "I am a psychology major [and] this was a really cool program to be able to see and learn from". This does not preclude broader life lessons, which are the outcome of any volunteering experience: "this experience has taught me to keep an open mind when addressing how to deal with a dilemma"; "This service especially taught me about parenthood and how crazy kids can be. They can be a real annoyance but in the end are so fun." A sense of reciprocity is also noticeable in the contributions: "I was able to learn things from all individuals I worked with and they were also able to learn things from me".

When we read the answers to the questionnaires, some limitation can be found. Through their service, it appears that students gain a good grasp of the educational system in Luxembourg, its difference from the US., its specificities (especially in terms of multilingualism). They also understand issues of poverty and need. In other words, they cover correctly two of the three learning objectives. However, they are weaker in dealing with the third one, pertaining to the "why"? Why such differences? What are the limits of inclusion? Why this and not that organization?

There are different ways to analyze such a limitation. One actually should make room for the fact that students are effectively trained to be respectful of their host country. They also enjoy their experience as volunteers, and even gain a higher appreciation for their host country due to their service. Such positive conditions make it difficult to adopt a more critical attitude towards their experience.

8. Conclusion

SL has reinforced the curriculum of a program abroad by providing innovative ways to reach its core objectives: make the students more familiar with their host country, separate their interests as travelers and as temporary immigrants (an aspect often skipped in the literature about study abroad) while embedding their sociology class in concrete social engagement. It has been the incentive for radical curricular innovation with the refugee language classes. Even more essentially, it has contributed to foster a reflection about the role played by a study abroad in the community as well as about the role played by this very community for this study abroad program. This is why, ultimately, we are talking about *Service Learning* and not about *Global* or *International Service Learning*. It corresponds to the elimination of a "missionary" understanding of service "from the outside". It also coheres with the conviction that educating the global citizen is giving her or him the responsibility to become a committed local citizen abroad.

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A transdisciplinary educational experience at the Botanical Garden around scientific travelers

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Abstract

In the framework of the transdisciplinary educational innovative project "Sciences and Arts" at the University of Valencia, we present here the design and outcome of an activity around the phenomenon of scientific travelers. It consisted in a scientific-literary tour through the Botanical Garden of the University of Valencia, which 100 students from the subjects "Natural Sciences for teachers" and "Literary training for teachers" attended together. The activity was designed as a collaborative work in which scientific travelers served as a pretext to address six educational aspects that the students from each subject tackled in two different ways: from a more scientific than literary approach and viceversa. The students valued very much the possibility of interaction with the other group, the fact that the expositions took place at a natural environment, the integrating of Sciences and Arts and the didactic transposition carried out.

Keywords: Scientific travelers; transdisciplinarity; preservice teachers.

1. A commitment to transdisciplinarity on teacher education. The innovative project "Sciences and Arts"

Since the early 1970's when the term was created and considered "still a dream" (Apostel, 1972: 138), transdisciplinarity has developed and is now related to synoptic disciplines (i.e. Geography, Philosophy, Religious Studies), comprehensive paradigms (i.e. Feminism, Marxism) or broad interdisciplinary fields (i.e. Cultural Studies) (Thompson Klein, 2004). It tries to create bridges between different areas of knowledge, as Nicolescu explains in his *Manifesto of Transdisciplinarity* (2002).

In Spain, there are a number of studies that reveal the need for curricular changes with the aim of integrating Experimental Sciences and Arts. The epistemological development of an environmental competence, and even the impulse of environmental classrooms and the design of didactic materials destined to the different educational levels are needed (Ull et al., 2014; Vilches Peña & Gil Pérez, 2015). These studies also highlight the lack of teachers in our country trained to face the environmental education of the 21st century.

In this context, the innovative educational project "Sciences and Arts" tries to address some of these issues. It was founded at the Faculty of Education of the University of Valencia in Spain during the academic year 2017-2018 and tries to break the departmental walls. Currently ten professors of three different disciplines (three professors of Literature, three of Social Sciences and four of Experimental Sciences) participate. Its purpose is to design didactic materials inspired in the integration of Sciences and Arts as well as explore their educational possibilities with pre-service teachers.

In short, the project "Sciences and Arts" is trying to develop a new way of teaching and assess its performance and use. Concretely we have explored different phenomena as feminism, environmental problems, knowledge transfer and scientific travelers.

The idea is that literary texts are a first-order resource for working sciences and that scientific content and reflection on environmental protection are not incompatible with Literature lessons. Renewing the processes of teaching and learning also require changing the educational system, as freirean pedagogy postulates. This point of view is aligned with an horizontal and interdisciplinary knowledge and basically incompatible with an inflexible, tight and curricular system based on monographic studies. Our ultimate goal with these activities is to promote the knowledge of students in relevant subjects as Language, Literature or Science, but always mixing together knowledge from those areas and subjecting them to a holistic, real and ethical training, including aspects related to ecology and environmental protection, but also civic responsibility or empathy.

In addition, it has been pointed out (Martín Ezpeleta and Echegoyen Sanz, 2018) that the nature of the Faculty of Education is a good environment for the students (who will be the

teachers of the future) to internalise the benefits of a way of learning completely aligned with the reality of teachers in schools. We cannot forget that, beyond the curricula, the task of teachers in schools is to integrate very heterogeneous contents and competences in their classes, which are not as tightly compartmentalized in subjects and specialties as in Secondary or Higher Education.

2. Didactic proposal around scientific travelers

We addressed the phenomenon of scientific travelers from a double perspective: the knowledge of the most relevant scientific travelers and the genre of travel journals and letters. We paid particular attention to the figure of Charles Darwin and his Voyage of the Beagle around the world between 1831 and 1836, that ultimate lead the author to publish his "Theory of Evolution", as well as to Alexander von Humboldt and the exploration of America between 1799 and 1804. In this case, in addition, we brought up his visit to the city of Valencia, of which he leaves a mark in his diaries, and his epistolary relationship with the Valencian botanist Antonio José de Cavanilles.

The key of the didactic activities prepared around scientific travelers is that they were implemented at the same time in prototypical subjects of Sciences and Arts at the Faculty of Education, such as "Natural Sciences for teachers" and "Literary training for teachers". Both are compulsory subjects, taught in the sophomore year of the Bachelor degrees in Early Childhood Education and Primary Education (in the case of the University of Valencia).

2.1. Objectives

1) To use scientific travelers to work (autonomously and collaboratively) contents and competences tradicionally related to Sciences and Arts in typical subjects of both disciplines.
2) To design transdisciplinary didactic materials for children around the topic of travelling and discovery.
3) To carry our a scientific-literary itinerary through the Botanical Garden with alumni from two subjects where a selection of the main conclusions and prepared didactic materials where shown, achieving a significative and peer learning.
4) To develop transversal competences, especially the communicative competence.

2.2. Methodology

With the aim of integrating Experimental Sciences and Arts in teacher education we use the phenomenon-based learning methodology (Symeonidis, & Schwarz, 2016) with the influence of Cultural Studies, which purpose is to train responsible citizens, as proposes Henri Giroux (2004). This approach advocates for integrating knowledge and skills of many diverse disciplines around a key phenomenon. In this manner, phenomena such as climate change or

biodiversity protection are not only studied from the Physics, Biology, Economy or Ecology points of view but also from Literature, Cinema or History. Based on this, we specify a series of methodological aspects:

1) The selected phenomenon is scientific travelers, which is associated with others like climate change, biodiversity loss or science fiction.
2) All the activities/tasks integrated contents and competences traditionally assigned to Sciences or Arts.
3) Collaborative learning and creativity are promoted, integrating the use of ICTs.
4) Transversal competences like communicative competence or gender equality are also addressed.

3. Scientific-literary tour through the Botanical Garden of the University of Valencia

The main activity from those around scientific travelers was a Scientific-literary tour through the Botanical Garden of the University of Valencia. The site was selected because it is well established that the nexus of experience and place offers significant promise for educational endeavours (Hill, 2013). This learning experience was aimed at utilising a holistic pedagogy engaging kinaesthetic/physical, sensory, and emotional facets of learning, as well as cognitive. One hundred alumni of two subjects "Literary training for teachers" and "Natural Sciences for teachers" participated. Each stop of the tour contained a common educational synthesis, which the students of both subjects had tackled in different ways.

The work was designed as jigsaw classroom (Aronson, 2002) in which each group was an expert on one topic (two different groups per topic) and explained it to the rest in two phases: first in a short exposition in the classroom to their classmates and then on a scientific-literary tour that both groups attended together at the Botanical Garden of the University of Valencia. The first exposition served so that the whole group could take advantage of the work of the companions and served as a general rehearsal for the exposition that would take place on the aforementioned scientific-literary tour. Each class was divided into twelve groups, in such a way that each topic was studied by two groups.

3.1. Preparing the activity. In the classroom

We designed a collaborative work with a duration of five classroom sessions (in addition to the self learning work) in which the alumni had to train in scientific and literary aspects at the same time. It was a project of the whole group composed of tasks carried out by small random groups of up to four students, who were going to study multidisciplinary documentation and materials provided by the teachers and organized around six scientific-literary topics.

These topics covered different educational dimensions related to the phenomenon of scientific travelers. They were materialized in two types of analysis, one from a more literary than scientific point of view, and another, from a more scientific than literary point of view. They wanted to be complementary and help reach the educational synthesis, as shown in Table 1.

Table 1. Educational synthesis and topics for both subjects.

Educational synthesis	"Natural Sciences for teachers"	"Literary training for teachers"
Travelling as a personal and professional training	The great scientific expeditions. Humboldt's journey	Scientific travelers in their letters. Alexander von Humboldt
The culture of flowers	Darwin's flower	The flowers of reason. Rubén Darío's roses
Literature as a travelling companion	The discovery of pinnaple (and other foods) in the indian chronicles	Diaries and chronicles of Christopher Columbus and Washington Irving, a round trip
The recognition of professional women	The quiet voice of women	The quiet voice of women. María Cegarra Salcedo
Environmental protection	Environmental humanities for children	Ecocriticism for children. The stories of Jen Green and Mike Gordon on environmental education
The beauty of nature	The natural beauty	Writers who were scientists and scientists who wrote. The aphoristic literature of Wolfgang von Goethe and Jorge Wagensberg

The bibliographical references and materials of each topic in the different subjects were a combination of academic texts, either from the fields of Philology, Natural Sciences, Literature Didactics and Experimental Sciences Didactics, among which were articles published in specific journals, book chapters and even doctoral theses. On the other hand, in both subjects the reading of popular science texts, published for the most part in the periodical press, was promoted.

In both subjects the six topics were studied in three phases. Firstly the topics in question had to be assimilated from the bibliographical references and texts provided by the professors (and any other that they wanted to search from themselves), who during the face-to-face sessions were in charge of making sure that were understood by the students. Then they had

to prepare a brief presentation that would explain their topic to their classmates. And finally they had to make a didactic transposition (Chevallard, 1988) of what they had learned. To do so, they had to design some didactic activities for children.

3.2. Carrying out the activity. At the Botanical Garden

The tour around the Botanical Garden was designed in a way that each topic was related to a particular place inside the Garden (i.e., "Darwin's flower" was explained at the greenhouse were the actual orchid grows, the topics about Christopher Columbus and the American discovery were explained at the tropical plants greenhouse, etc.), the itinerary with the stops is shown in Figure 1.
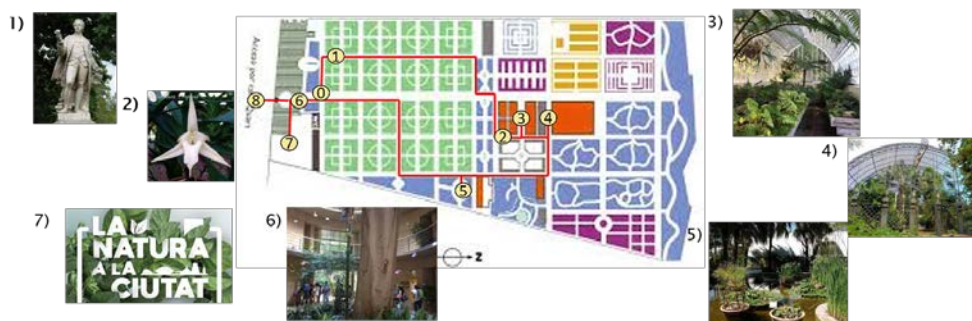
Figure 1. Itinerary and stops at the Botanical Garden .

The scientific-literary tour was carried out twice, distributing half of each group of "Literary training for teachers" and "Natural Sciences for teachers" in one day so that classes and disciplines were mixed up and the six educative synthesis with both perspectives were listened by all students. The objective was to cross the expositions that had been prepared in the context of different disciplines and with different biases, to invite students to delve into the scientific-literary issues from different and complementary perspectives, but also to experience the benefits of transdisciplinary projects.

The intervention of each group of students had three parts: reading of a text of their choosing related to their topic (some read a poem, others a letter, a fragment of a novel…); a short exposition of the topic they had worked on; and explaining in detail one of the didactic activities aimed at Primary Education children from the three or four they had prepared, showing some materials (texts, images, stories, objects, etc.).

To dinamize the activity a diary of the tour were the students could show their impressions and opinions was written voluntarily during the itinerary and a twitter contest (@ciencylet, #cienciasyletrasnaturalmente) took place to select the best photo.

3.3. Evaluating the activity. Students' assessment

The students were asked to select their favourite activity of the semester and 82.4% selected the scientific-literary tour through the Botanical Garden. When asked about which aspect of the activity they valued the most, 92.1% selected the exposition at the Botanical Gardens and 7.9% selected the exposition in the classroom.

The students opinions, that they were asked to write in the form of a short assessment, were all very positive. Here we present some fragments: "After preparing, with great enthusiasm, the exposition, the activities and their materials the big day of the excursion to the Botanical Garden arrived. Just before entering we were informed of the hashtag that had to be used and I was excited by the idea, since two of the things that I liked doing the most were united: flowers and nature with photography (A.M.)"; "When we got there, we met with the group of students in the Literary Training class, the main idea was to show our work, since they were related to each other, but treated from the scientific and literary point of view. This is a very enriching practice, since both contents complemented each other and gave rise to a more complete sense of what was being explained (V.O.)"; "With this visit it was shown how Literature and Sciences are transversal instruments through which the learning of concepts and processes belonging to these two disciplines can be promoted and facilitated. Literature can bring science to students who are not so interested in it or the reverse process can happen, that through science a student will discover the world of literature and see how related they are to each other (I.R.)"; or "At the tour it was very enjoyable to go walking through the Botanical Garden and alternate the places of explanation, because we could travel a lot of spaces that, in one way or another, were related to the expositions, such as Darwin's flower (I.F.)".

4. Conclusions

We have been able to integrate contents and competences of different disciplines around activities like the one here detailed about scientific travelers with this educational innovation project revolving around phenomenon-based learning. In addition we highlighted two key figures in the History of Science as Charles Darwin and Alexander von Humboldt (this last unknown by most of the students).

The opinion of the students about the different activities were very positive. They especially valued the possibility to be in contact with students from other groups and the fact of learning in a natural environment. They also highlighted the integration of Sciences and Arts and the reflection that entailed, as well as the opportunity to prepare some materials for children during the didactic transposition.

We propose that these phenomena and didactic activities can structure the official educational curricula in the future, in contrast to the general rule of organization in separate scientific

disciplines. The pretension to integrate contents and competences in a learning that turns around the resolution of problems, which stimulates the empathy, curiosity and motivation of the students is old, but until now it has not permeated the dominant educational system. The combination of all these ingredients can only offer a positive result, which is precisely a holistic, real and ethical education.

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The value of 'writing retreats' in advancing innovative pedagogic research

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Abstract

This paper outlines the work of the Centre for Innovation in Higher Education, which uses an educational laboratory model to advance the intersection of innovative research and teaching at Anglia Ruskin University (ARU). This evidence-based approach aims to promote active, reflective engagement with research in teaching and learning; foster collaborative and interdisciplinary inquiry into pedagogic practice; and support the development of a dynamic, sustainable pedagogic research community at ARU.

The Centre's work also increases the visibility and calibre of pedagogic research at national and international level. This paper describes a current research project being undertaken by researchers from the Centre and Anglia Learning & Teaching which explores the longitudinal impact of its writing retreat provision on participants' writing practices and productivity, together with their perceptions of writing as a key element of the academic identity. This study is generating valuable original data about academics' writing practices and perceptions. It will contribute to the understanding of this important topic at a theoretical level, as well as outlining practical means through which universities can foster long-term academic writing productivity leading to enhanced research impact.

Keywords: writing retreats; academic writing; pedagogic research; interdisciplinary research; qualitative research; educational laboratory model

1. Introduction

The Centre for Innovation in Higher Education was launched by Anglia Ruskin University (ARU) in July 2018 to advance the intersection between innovative educational research and pedagogic practice. ARU is a teaching-intensive university with strengths and distinctiveness in learning, teaching and assessment, and the Centre was created to enhance these strengths through applied research into teaching and learning; to make visible the impact of what ARU is already achieving in pedagogic excellence; and to foster new initiatives and further innovation in this area.

1.1. An educational laboratory model

The Centre employs an 'educational laboratory' model: that is, an active, collaborative and creative approach to pedagogic research. Key to this approach is the provision of opportunities for colleagues not merely to *hear about* excellent or innovative practice in teaching and learning, but to *design, discuss,* and *reflect on* those practices. The Centre runs various events throughout the year, all of which are designed to foster active and reflective engagement with aspects of pedagogic research, including seminars, an annual international conference, regular writing retreats, and monthly pedagogic research community meetings.

1.2. Pedagogic research: the intersection of discipline knowledge and teaching practice

Through its use of the educational laboratory model the Centre seeks to help colleagues bridge the gap between their own subject expertise and the practice of pedagogic research. Researchers accustomed to working within the methodological and epistemological frameworks of their discipline often experience difficulties in adapting to the thinking, practices and conventions of pedagogic research, which falls within the domain of the social sciences (Hutchings & Shulman, 1999; O'Brien, 2008). They may be unfamiliar with the ethical requirements of conducting research with human subjects; with framing qualitative research questions rather than positing hypotheses; and with issues of rigour, reproducibility and generalisability in qualitative research (O'Brien, 2008).

Pedagogic research necessitates a dual disciplinary focus (Bennett & Dewar, 2012; Coonan, 2019). Colleagues engaging in pedagogic research will be conducting an inquiry into the teaching or learning of their subject - be that Biochemistry, Law, Nursing, Construction, or any other subject domain in which major courses are taught. The object of the research is not to expand disciplinary knowledge, but to explore the means through which an understanding of that knowledge is supported and developed in students. This includes, for example, barriers to understanding that body of knowledge, and how they may be overcome through teaching; the "threshold concepts" or "troublesome knowledge" unique to the subject area (Meyer & Land, 2005, p. 373); and the cognitive practices, conventions and 'ways of thinking' through which the knowledge is constituted and developed.

2. How the Centre supports colleagues engaged in pedagogic research

The Centre has established a number of supported routes to engaging in pedagogic research in order to develop an active and sustainable community of practice at ARU.

2.1. Advice and collaboration

The Centre's research staff has a wide range of expertise that encompasses not only educational theory, practice and research design, but also academic writing practices, qualitative research methods, and the scholarly publishing landscape. They have created a number of resources to aid colleagues in developing a pedagogic research project, including designing research questions; collecting and analysing data; articulating the value and originality of the project; and the ethics of conducting pedagogic research. Where appropriate, the Centre can offer full collaboration on pedagogic research projects, with researchers from the Centre acting as co-investigators.

2.2. Learning and Teaching Project Awards

In addition to the provision of advice and collaborative opportunities, the Centre supports Anglia Learning & Teaching in co-ordinating ARU's annual Learning and Teaching Project Awards (LTPA). These provide financial assistance for pedagogic research and offer the opportunity to conduct small-scale research projects over the course of each year to enrich and inform teaching practice and enhance the learning experience of ARU students.

Preliminary results of doctoral research into the impact of reward and recognition schemes on teaching excellence (Warnes, 2018) indicate that teaching fellowships (such as the National Teaching Fellowship scheme), are retrospective and only recognise teaching excellence once it has been achieved. In contrast, the primary focus of developmental programs, such as the LTPA scheme, is to support early career academics to develop both their research *and* teaching skills. Warnes (2018) reinforces this by suggesting that teaching fellowships have little or no impact on the student experience, since students are already benefiting from excellent teaching, while, conversely, the LTPA scheme may have an immediate impact, as action research projects evaluate and refine innovative pedagogic interventions.

2.3. Strategic Projects

The Centre also offers 15-week Strategic Project windows each semester which release Faculty staff from teaching, learning, assessment and administrative duties in order to engage in intensive, high-impact pedagogic research projects with fully funded support from the Centre. Projects to date have included research into digital credentialing of learners' interactions with curricular and co-curricular activities, and design thinking principles in module development.

2.4. The Pedagogic Research Community

Through the educational laboratory model, manifested in the activities, events and research opportunities outlined above, the Centre works to foster a sustainable pedagogic research community engaged in ground-breaking teaching and learning at ARU.

The Community is sustained through regular monthly meetings, open to all staff engaged or interested in pedagogic research, and generally featuring speakers drawn from the community itself. These meetings are supplemented by a website containing an index of pedagogic research journals; a directory of staff engaged in pedagogic research at ARU; and a purpose-built online directory containing community's scholarly publications together with downloadable resources produced by the community to support teaching and students' learning. The impact of the Pedagogic Research Directory has been analysed using a mixed method approach (Pratt-Adams & Warnes, 2018, manuscript submitted for publication). Findings indicate that use of the Directory is increasing and that members of the pedagogic research community use the resource in various ways, including showcasing their scholarly outputs and identifying collaborative opportunities with colleagues.

Most recently, researchers from the Centre have employed the educational laboratory model to design a research project exploring the impact of another of its flagship support initiatives, writing retreats. This original research is outlined in the next section.

3. Longitudinal impact of writing retreats on participants' writing practices

The Centre runs full-day Pedagogic Research Writing Retreats several times per year. These events offer intensive time for writing in company with others, with a light-touch structure designed to help participants maintain their focus, write productively, and develop effective writing strategies.

In January 2019 the Centre launched a research project to investigate the ongoing impact of attending a Writing Retreat on participants' writing practices and habits. This study investigates the writing practices of both academics and professional services colleagues, exploring how they move between disciplinary identities and construct new interdisciplinary voices through their pedagogic research writing.

3.1. Study background

Academic writing productivity is a crucial measure of impact for UK universities, unlocking research funding and contributing significantly to universities' status and reputation in an era of increased accountability measures. Writing retreats have become a popular means to increase universities' published outputs (Murray & Newton, 2009).

Although evidence exists that writing retreats are an effective means of increasing academics' writing productivity (see e.g. Oermann, Nicoll, & Block, 2014; Kornhaber, Cross, Betihavas, & Bridgman, 2016), it is not well understood why this is the case (MacLeod, Steckley, & Murray, 2012). However, MacLeod et al. (2012) assert that writing retreats enable the acquisition of writing strategies and the containment of anxiety, while Murray and Newton (2009) found that retreat participants reported changes in their approaches to writing and their awareness of their own identity as writers.

3.2. Method

The research is being conducted through analysis of existing evaluation forms together with up to 25 semi-structured interviews with colleagues who have attended a Pedagogic Research Writing Retreat. Interviews explore participants' anxieties, fears and confidence levels around writing; blockages experienced by participants, and solutions used to address them; the development of strategies to increase writing productivity and/or address anxieties; and how participants maintain (or not) a writing habit between retreats..

Interviewees are self-selecting, choosing to respond to a general invitation email sent by the Centre administrator, and the interview phase is ongoing. Analysis began on completion of the first interview, employing an emergent coding method (Saldaña, 2009). Ethical application was granted by ARU's Education Research Ethics Panel (protocol number ESC-SREP-18-153).

3.3. Preliminary findings

Attendees are invited to completed evaluation forms at the end of each retreat. Responses show that the majority were able to achieve their intended purposes, which included a range of activities from planning and outlining papers, book/doctoral thesis chapters, and project proposals, to writing complete papers and articles.

Around 80% of attendees confirmed that they had learned new writing habits, including regular scheduling of writing time, planning the writing, taking breaks, and free writing. Benefits noted by attendees included:

> Being forced to take a break(s) was useful: I came back refreshed
>
> To keep writing without stopping to edit
>
> Free writing. Plan - working to a plan. Timing
>
> Planning writing. Thinking about using time effectively

Attendees particularly valued the peace and quiet of the retreat, in which it was possible to "Just sit quietly and get on with it!" In addition to feeling comfortable in the loose, but strictly enforced, structure, many attendees expressed their appreciation for having the Time:

…and space

…away from constraints

…away from students, managers, teaching and emails

…to focus on writing without interruptions

…to undertake nothing but writing

…to write with peers who were doing the same

…out from the day job!

One particularly salient comment referred to the 'peer normalisation of writing up research'.

Following several requests for additional retreats, including a request from one attendee for "more regular retreats! Not necessarily all day or off site if this means they can happen more often", the Centre has introduced informal, writing drop-in sessions, once per semester, in the evenings, on each of our two main campuses.

Building on the analysis of the evaluation forms, the semi-structured interviews have brought a number of new issues to the surface. Some participants demonstrated a very high level of reflexive awareness of their own writing habits, and extremely strategic approaches to managing the writing load. Notably, one interviewee (who had attended three retreats) employed a deeply nuanced extended metaphor to describe how they consciously manage their depth of engagement with each writing task:

I probably concentrated on something else for a bit – came up out of the depths of trying to, trying to write *stuff* to look at the structure […] so I wasn't going down the same road. I came up, had another look at the map, and thought perhaps I can go down this bit here, look at that scenery for a bit …

A valuable point that emerged early in our interviews was the need to move between research identities and voices, and the degree of ease with which this is effected. Participants attending a writing retreat are, necessarily, engaged in the practice and language of two fields: that of their 'home' discipline, and that of pedagogic research. Moving from one into the other is not always straightforward. One participant disclosed that:

I do find the language of getting into the pedagogy difficult, because I've come from a scientific background so […] I feel like an alien.

The interviewee underlined this sense of unfamiliarity by comparing their pedagogic research writing to "going on a city break": a "just visiting" experience.

Although writing is not usually performed collaboratively at the retreats, the experience of sharing the writing space with others was perceived as a significant benefit by many

participants, for a variety of reasons. These ranged from becoming aware of new practices and approaches – seeing other people's habits, that somehow they'll rub off on me and I'll be a better writer – to feelings of reassurance on perceiving others' practice:

> I like to be around people that are also writing: that makes me feel like I'm on the right […] route, on the right track

> it [writing] can be messy, and that's OK.

The shared writing space can therefore offer a means of addressing writing anxiety, or as one interviewee put it, the "emotional stuff that's not actually the writing but *is* the stuff that kind of goes around the writing".

4. Conclusions

Early findings from the study on the impact of pedagogic research writing retreats suggest that this strand of the support offered by the Centre is highly valued and makes a substantive contribution to writing productivity, not only at the level of actual output but in terms of participants' writing habits and practices, including the management of anxiety associated with writing.

The educational laboratory model employed by the Centre increases the visibility of ARU's pedagogic excellence and achievements, and supports new initiatives and further innovation in this area. It also increases the visibility and calibre of pedagogic research at national and international level through original research, including its inquiry into the longitudinal impact of writing retreats. In promoting the visibility and reach of pedagogic research and evidencing its value to scholarly knowledge, the Centre for Innovation in Higher Education enhances the reputation of pedagogic research not only at Anglia Ruskin University but nationally and internationally.

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Teachers' perceptions about the use of the Learning ePortfolio as learning and assessment tool in Mondragon Unibertsitatea

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Abstract

The aim of the present study is to analyse teachers' initial perceptions about the use of the Learning ePortfolio as the main learning and assessment tool in Early Years Education and Primary Education Degrees. This is a piece of a major longitudinal research being carried out in the Faculty of Humanities and Education in Mondragon Unibertsitatea. Results show that teachers are aware of the flexibility offered by the Learning ePortfolio to assess students' learning processes. Indeed, teachers think the Learning ePortfolio is a valuable tool for both students and teachers. However, there are still some outstanding issues to discuss with all the teachers involved in the use of the Learning ePortfolio. Conclusions drawn from this study show that the Learning ePortfolio constitutes a helpful and valuable tool for both students and teachers and it helps when carrying out formative assessment processes. Nevertheless, more training is needed to solve the gaps identified for its use.

Keywords: Learning ePortfolio; formative assessment; higher education.

1. Introduction

Traditionally a portfolio was a tool which emerged from arts and used as a showcase for the best works. In educational contexts, the use of the portfolio began in the USA and in the UK (Alcaraz, 2016), not as a showcase but to collect experiences and reflect on them (Hartnell-Young et al., 2007) as well as to organise, design and assess students' learning processes (Bahous, 2008). In Europe was not until the 90s that the portfolio arose in educational contexts (Alcaraz, 2016; López-Fernández, 2008). Precisely, much innovations carried out in the field with portfolios and ePortfolios have been associated to learning and assessment (Alcaraz, 2016; Pérez-Gómez & Serván-Núñez, 2016). In Spain, where this study was carried out, the ePortfolio has been used since the beginning of the 21st century in teaching and learning processes up to its capability to promote metacognitive development (Klenowski, 2004) and to widen learning experiences (Scully, O'Leary, & Brown, 2018). In fact, the use of ePortfolios is becoming common in higher education, both in international contexts (Clark & Eynon, 2009; Soto, Barquín, & Fernández, 2016) and in Spain (Alcaraz, 2016; Cobos, López, & Llorent, 2016).

Klenowski (2004) states that the ePortfolio can be used in five different ways: 1) summative assessment; 2) competence certification and candidate selection; 3) promotional use; 4) teaching and learning support; and 5) professional growth. In connection with the fourth use –the ePortfolio for teaching and learning support– some authors (Pérez-Gómez & Serván-Núñez, 2016; Scully et al., 2018) rename the ePortfolio as the Learning Portfolio because of the fact that learning and assessment could be fostered by its meaningful use.

As far as Learning Portfolios are concerned, Scully et al. (2018) differentiate between three types: 1) as *process* which is valuable for students to reflect on their learning development; 2) as *product* where students could showcase their learning process; and 3) as *dual goal orientation* which encompasses the previous two by including drafts and artefacts related to learning processes together with finished products.

In any case, it is not possible to envision a learning process without taking into account its assessment approach (Biggs & Tang, 2011). Nowadays, there are many competing assessment approaches as Hill and Barber (in Siarova, Sternadel, & Masidlauskaite, 2017, p. 34) state: summative assessment or assessment of learning, formative assessment or assessment for learning and assessment as learning among others. Hayward (2015) goes even further when stating that assessment is learning.

Reflection and continuous feedback are considered significant elements of learning processes (Siarova et al., 2017). McLaren (in Siarova et al., 2017, p. 63) conclude that "providing feedback to pupils [or students] brings positive results in supporting learning, teaching and assessment, and that it also brings useful evidence for […] formative assessment purposes". And the latter is precisely related to the general objective of the ePortfolio as Klenowski,

Askew and Carnell (in Scully et al., 2018, p. 2) claim: "[…] [the ePortfolio's] overall goal is to facilitate and document learning and development over time". This is why the ePortfolio has gained importance as an assessment system in higher education (López-Fernández, 2008). As the author states, the ePortfolio arise:

> as a new way to conceive the assessment that offers the opportunity to design a different system, with a new tool, which facilitates the acquisition and pursuit of learning, through the new roles assigned for teachers and students (López-Fernández, 2008, p. 55).

Nonetheless, further research is needed according to various research studies (Arís & Fuentes, 2016; Klenowski, 2004; Scully et al., 2018). More specifically, as Parker, Ndoye and Ritzhaupt (2012, p. 105) stress, studies of Learning ePortfolios in "[…] teacher preparation programs is an open-ended realm of research". In this line, the main aim of this study is to open new insights into students' and teachers' perceptions about the use of the Learning ePortfolio as the main learning and assessment tool in Early Years Education and Primary Education Degrees.

To sum up and bringing it all together, at the Faculty of Humanities and Education from Mondragon Unibertsitatea (Basque Autonomous Community, Spain) an institution-wide Learning ePortfolio was implemented in the Early Years Education and Primary Education Degrees in 2017/2018 academic year. To start the process some training sessions with teachers and students where organised at the beginning of 2017/2018 in order to give teachers and students support in teaching and learning processes (Table 1). Moreover, a specific guide was created as a common reference for teachers and students. Both learning process and achievements are reflected in the students' ePortfolios, so the dual goal orientation Learning ePortfolio proposed by Scully et al. (2018) is being used (Table 1). Furthermore, students are the ones in charge of using their Learning ePortfolio for their own personal and professional development and teachers are responsible for guiding students in their learning process. So continuous feedback is needed and given to students, placing everyone in the formative assessment approach (Table 1).

Table 1. The Learning ePortfolio's approach in the Faculty.

Usage	Type	Assessment approach
Teaching and learning support	Dual goal orientation	Formative assessment

Source: own elaboration.

2. Method

2.1. Context

This ongoing longitudinal research is being carried out in the Faculty of Humanities and Education from Mondragon Unibertsitatea in the Early Years Education and Primary Education Degrees. As stated before, the Learning ePortfolio was introduced at the beginning of 2017/2018 academic year in the Faculty. The first study was carried out during this academic year (Figure 1) with first year students and their teachers. Conclusions were drawn from Study 1 (see SantaCruz, Ipiña, & Astigarraga, 2018a, 2018b) and some changes were made in the Learning ePortfolio's approach for 2018/2019 academic year. This paper focuses on what has been done during the first term of this academic year (Study 2). This second study is being carried out during 2018/2019 academic year (Figure 1) with first and second year students and their teachers.
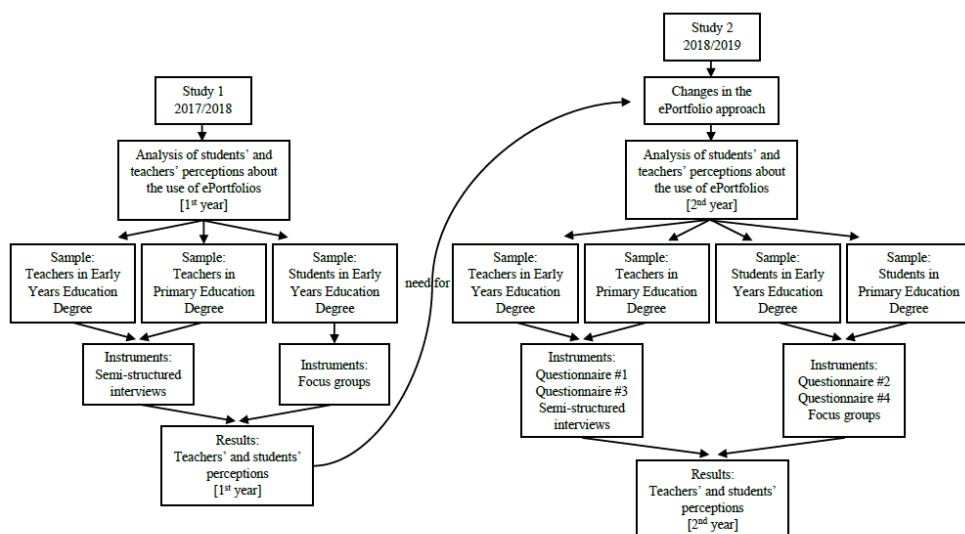
Figure 1. Studies, participants and research instruments. Source: own elaboration.

Two online open-ended questionnaires (Questionnaire #1 and #2 in Figure 1) have been designed *ad hoc* and delivered to teachers and students during the first term: a questionnaire for teachers and a questionnaire for students. Questionnaires #3 and #4 (Figure 1) will be delivered at the end of this academic year intending to compare pre-post answers. Semi-structured interviews will be conducted with teachers and focus groups will be carried out with students during 2018/2019 (Figure 1). Thus, a data triangulation process will broaden validity to the analysis.

The purposes of the teachers' questionnaire are to find out what use teachers have made to students' Learning ePortfolios so far and to identify their needs. In contrast, the aim of the students' questionnaire is to find out in what way students think their Learning ePortfolio will help them develop their personal and professional skills. The present paper is limited to teachers' perceptions. The questionnaire has been delivered to every teacher involved in the first and second years in Early Years Education and Primary Education Degrees (N=50). A week was given to answer the online questionnaire and 60% replies were received.

2.2. Data analysis

Content analysis methodology has been followed in order to categorise teachers' perceptions about the use of the Learning ePortfolio as the main learning and assessment tool. A combination of *etic* –researchers' categories– and *emic* –non-expected categories identified in the corpus– has been made to identify the categories shown in Table 2.

Table 2. Categories and subcategories from Questionnaire #1.

	Category	Subcategories
1	Use	Non-use
		Follow-up
2	Value	Validity
		Satisfaction
3	Needs	Not needs
		Training
		Students' technical need
		Sharing approaches

Source: own elaboration.

The categories and subcategories were agreed upon by three researchers. The categories named as *Use* and *Needs* are researchers' categories, whereas *Value* is the non-expected one identified in the corpus.

3. Results

Findings in this study show that 40% of teachers who answered the questionnaire mentioned the use (Category 1 in Table 2) they have made of students' Learning ePortfolios so far. Results show that two groups of teachers were identified. While some teachers have not begun using students' Learning ePortfolios yet, others made connections between the Learning ePortfolio and the assessment process. In fact, some participants in the study are aware of the opportunities the Learning ePortfolio offers to assess students' learning processes. As Teacher 11 stated:

> *I met my students one by one and I gave feedback to them on their first three artefacts uploaded into their Learning ePortfolio. Most of my students are now able to understand what an artefact is and how they could go more in depth in it from now on.*

Furthermore, 20% of teachers believe in the value of the Learning ePortfolio (Category 2 in Table 2). They stated that the Learning ePortfolio is a valuable tool for both teachers and students. Teacher 7 for example claimed the following after using it: "*it is an outstanding tool for teachers to mentor and follow-up students' learning processes, as well as for students to self-regulate and to develop their own personal and professional skills*".

72% of participants who answered the questionnaire mentioned some personal needs (Category 3 in Table 2). There is a group of teachers who did not identify any special need during the first term of this academic year due to the fact that they used the guide created as a common reference to clarify their doubts. In addition, Teacher 21 stated the following:

> *I have not used students' Learning ePortfolios this term, but I would not have needed any help if I had had to use them because the guide explains quite clearly what the Learning ePortfolio is and how we should use it.*

Nevertheless, the perception of most participants who have already used students' Learning ePortfolios is that there are some issues that need to be discussed and agreed. Teacher 12 claimed the following: "*I do not know how to use students' ePortfolios*". And Teacher 18 admitted that "*my feeling is that I am really confused with the ePortfolio's approach*". In addition, Teacher 5 affirmed that "*we do not all understand in the same way the Learning ePortfolio's approach. Besides, not sharing a common view on the Learning ePortfolio could impact in a negative way on its use*". In this line, teachers need some training as Teacher 26 requested: "*I would need at least a half-morning training session about the Learning ePortfolio*".

4. Discussion and conclusions

New insights into teachers' perceptions about the use and needs of the Learning ePortfolio for the first term of 2018/2019 academic year have been revealed in this paper. Firstly, results depict that participants began connecting the Learning ePortfolio with formative assessment processes. That is to say, participants are becoming aware of the opportunities the Learning ePortfolio offers to assess students' learning processes as stated Alcaraz (2016), López-Fernández (2008) and Pérez-Gómez and Serván-Núñez (2016) among others.

Secondly, teachers released that the Learning ePortfolio is a helpful and valuable tool for both students and teachers. As demonstrated in the findings, students could self-regulate their own learning process and teachers could follow-up students' learning processes by giving

them tailored feedback on what they are reading in their students' ePortfolios. Hence, students would be able to continue improving their learning processes while learning and this will contribute to formative assessment (Siarova et al., 2017).

Finally, there are some gaps that need to be discussed and agreed with all the teachers involved in the use of the Learning ePortfolio and for this purpose training and shared-spaces are needed. A training session was conducted at the beginning of this academic year trying to respond to a need identified in Study 1 in 2017/2018 as SantaCruz et al. (2018a, 2018b) concluded. Moreover, a guide was created explaining what the Learning ePortfolio is and how it should be used in Education Degrees in the Faculty. Even though, findings from this study have evidenced different views regarding the training needed: whereas some teachers believe they do not need any additional training, most of the participants are confused with the Learning ePortfolio's approach. So a new training programme for the next academic year should be designed in order to align the use of the Learning ePortfolio with the formative assessment process.

4.1. Limitations and further research

Conclusions must be viewed within the limitations of this study. In faith, the following limitations have been found in the present study. It is important to remind readers that this is only a piece of a wider longitudinal research. In this line, we have only focused on teachers' perceptions in this paper and students' perceptions are needed to understand the use of the Learning ePortfolio in the Faculty on a more specific way. Therefore, only a questionnaire has been delivered to collect data, so we are not able to triangulate data in this paper. But as shown in Figure 1, we foresee to have a wider and more specific picture of the use of the Learning ePortfolio in the Faculty by the end of this academic year.

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Student ratings to evaluate the teaching effectiveness: Factors should be considered

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Abstract

The study discusses the student ratings of a professor teaching sociology disciplines in different undergraduate courses. The data were obtained from questionnaires consisting of a series of inquiries about the discipline, focusing on how it fits in the curricular structure (discipline evaluation) and, also, on teacher's performance (professor evaluation). A total of 480 students answered the questionnaire and, for each question they had a total of five possible answers: very poor (1 point), poor (2 points), fair (3 points), good (4 points) and excellent (5 points). Considering discipline and professor evaluations, students from Animal Science, Food Engineering and Veterinary Medicine courses consider "fair" the performance of the sociology professor. Regarding to the professor evaluation, the students of the three undergraduate courses considered the performance of the teacher "good". For discipline evaluation, the Animal Science and Veterinary Medicine students considered the discipline "fair" and the Food Engineering students considered the discipline "poor". The results obtained can serve as a basis for the design of a institutional evaluation system of teaching based on student ratings, however the evaluation of the discipline and the performance of the teacher must be considered separately.

Keywords: course evaluation; higher education; teaching evaluation.

1. Introduction

Student evaluation of teaching has an important role when it comes to measuring the quality of high-level education and it has been used as one of the most important indicators of teaching effectiveness (Kulik, 2001). As a rule, gathering feedback from students through questionnaires (Serrano & Rueda, 2001) is a frequently used method in most universities around the globe and it has been generally accepted by those involved. However, once this method is adopted, some criteria must be established to assure its effectiveness (Garcia-Garduño, 2003).

The first step is to determine the main objective for applying the feedback form, since it can be used to assess the administrative sphere as well as faculty's teaching performance and student learning (Ory, 1990). One of the most important goals of the evaluation centered in student feedback is to give teachers a more deep understanding of the effectiveness of their teaching methods. According to Stake (2006), a comprehensive evaluation should highlight both positive and negative aspects in teaching practices. Therefore, the author considers the evaluation as participatory when it summons those involved in the process to actively engage, in a thoughtful manner, in the activity.

The tensions surrounding the classroom in the contemporary university bring about constant changes in the ways of teaching and demand a better comprehension of the teaching-learning process and how the relationship between professors and students affects it. As stated by Krasilchik (2009), teachers focus primarily in the subject they teach, which is desirable, but only if they do not lose sight of students, those who will receive such teachings. For that reason, the ultimate goal of participatory evaluation is to give students a voice in a systematic and organized way.

In the past, our University adopted an institutional evaluation system through online surveys distributed in all Colleges and Institutes. Nevertheless, due to low participation rates, this evaluation method was extinguished. In fact, the research literature shows this as a commun phenomenal: undergraduate students don't usually take part in online surveys to evaluate their teachers and courses (Avery *et al*. 2006, Adams & Umbach 2012), although higher participation rates can be achieved when universities divulge the importance of student engagement in the evaluation process (Young et al. 2018). Actualy, in our College the online survey system has been currently used to classify the data obtained and, thus, have immediate results.

This study aims to reflect on some aspects that have to be considered when this type of student evaluation of teaching methods is institutionally applied, especially when these evaluations are used as criteria to improve teaching effectiveness. It is already documented that the result of the student ratings is dependent on the undergraduate course and discipline evaluated (Uttl & Smibert 2017). Finally, our paper discusses the experience of one

particular faculty member, responsible for sociology discipline as a component of curricular structure in different Biological and Engineering undergraduate courses.

2. Method

The following data were obtained from feedback forms. The questionnare was divided by two parts and each part focused on a different evaluation object: 1) the discipline and how it is positioned in the curricular structure discipline evaluation) and 2) the individual faculty member's teaching efficacy (professor evaluation). As it is clear, these two different aspects structured the entire evaluation process, because it stimulates students and encourages them to formulate organized answers. Furthermore, by separating these different aspects of the teaching-learning process, students are allowed to elaborate deeper observations on each theme. In fact, this was one of the main objectives when we adopted this separation method in the structure of the form: by allowing students to focus specifically on each theme, they can reveal how they understand the division itself while answering each question.

Table 1 displays the individual questions, all concerning one same teacher who is responsible for the sociology discipline in three different undergraduate courses: Animal Science, Food Engineering and Veterinary Medicine. The questions involving discipline (1 to 3) and professor (4 to 7) evaluations were built in a multiple-choice format with five options: very poor (1 point), poor (2 points), fair (3 points), good (4 points) and excellent (5 points). From this configuration a quantitative analysis was carried out to identify the possible effects of the discipline and undergraduate courses in the student evaluation of the professor. The questionnares were anonymously applied by an online survey platform at the end of the semester. The data collected is the result of 480 student evaluations (160/course).

Table 1. Questions used to Student Evaluation of Teaching.

N	Questions
1	Is there integration of the discipline with the others of the course?
2	Is the discipline important to your higher education?
3	Are the prerequisites necessary to follow the discipline sufficient?
4	Have the contents been clearly taught?
5	Was the evaluation coherent with the topics presented in the classes?
6	Did the professor stimulate your critical thinking?
7	Did the teaching methods captured your interest?

1 to 3 = Discipline, 4 to 7 = Professor.

3. Results

Considering discipline and professor evaluations, Animal Science, Food Engineering and Veterinary Medicine students assessed the Social Sciences teacher's performance as "fair", as shown by the following data: 3.7 ± 0.4, 3.3 ± 0.5 e 3.8 ± 0.4, respectively. Figure 1 displays the score means of questions referring to the discipline assessment (questions 1 to 3) and individual teaching efficacy (questions 4 to 7) for each undergraduate course. Regarding the professor evaluation, students from all three courses considered it as "good", as shown by the following average scores: 4.0 ± 0.4, 4.1 ± 0.5 e 4.4 ± 0.4 for Animal Science, Food Engineering and Veterinary Medicine, respectively. When it comes to discipline assessment, Animal Science and Veterinary Medicine students considered the discipline as "fair": 3.4 ± 0.2 e 3.4 ± 0.1, respectively. On the other hand, Food Engineering students considered the discipline as "bad", with an average score of 2.4 ± 0.3. This lower results were due to the fact that most students felt that the Sociology discipline did not really fit into their curricular structure (question 1).
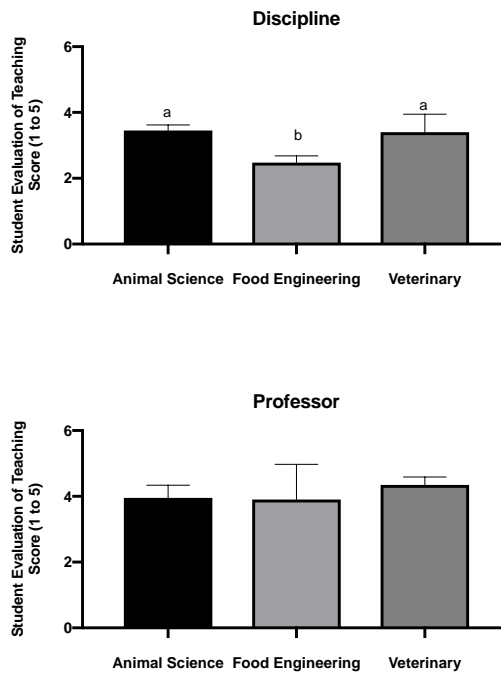
Figure 1. Means ± SEM of Student Evaluation of Teaching Score;
1=Very Poor, 2=Poor, 3=Fair, 4=Good, 5=Excellent.
Different letters = P<0.05.

4. Discussion

Our preliminary study indicates that student evaluation of teaching could be institutionally applied to promote a diagnosis about teacher performance. The participation of the students in this process demands the understanding of how students see their classroom, their teacher's role in their education process and their particular way of accumulating knowledge and establishing relations between such knowledge and their own discoveries. It is also very relevant the perception that the students have about the impact that an evaluation system can have on the group of their teachers. However, some factors should be considered when the purpose of the institution is to use student evaluation as one of the criteria for promoting the teaching career.

One particular factor has to be considered when it comes to producing the feedback forms and the interpretation of the results. Usually questionnaires are composed by questions related to teacher's performance in the classroom and other questions that involve the relevance of the discipline within the curricular structure. According to our results, students from all three undergraduate courses rated the professor as "fair". However, these results do not entirely reflect teacher's performance, since they derive from an overall analysis of the data collected. Furthermore, once we analysed these results by separating professor evaluation from discipline evaluation, students from all three undergraduate courses considered teacher's performance as "good", while the results concerning discipline varied according to each undergraduate course. Animal Science and Veterinary Medicine students considered discipline as "fair", while Food Engineering students considered it as "poor". The results emphasize something already pointed out by the research literature: many factors can affect the results of student ratings, especially when it comes to assessment of teacher's performance (Kulik 2001, Beran & Violato 2005, Uttl & Smibert 2017).

Another important factor to be considered refers to the discipline and/or undergraduate course. The Social Science disciplines (in this case, Sociology) as a component of curricular structure of Biological the Engineering courses have been the focus of the present study because of its interdisciplinary character. It is clear that even if Food Engineering students rated teacher's effetiveness as "good", they do not believe that this discipline is important to their education or professional goals, since the discipline doesn't openly relates to others in the Food Engineering curriculum. This shows that student evaluation can be also used to reformulate pedagogical projects (Steyn *et al*. 2018).

This research show that higher education institutions can use the student ratings for various purposes using a single questionnaire. However, the questions elaborated for each purpose should be analyzed separately. Questions involving the discipline as part of the curricular structure should be avoided when student ratings are used to measure teaching effectiveness.

Finally, the results obtained may lead to the elaboration of an institutional evaluation method based on student evaluation of teaching. This evaluation method can also create for faculty members moments of reflection and self-evaluation, allowing them to define what kind of changes and improvements could be implemented on a day by day basis. However, the evaluation of the discipline and the performance of the teacher must be considered separately.

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University performace through Multiple Factor Analysis

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Abstract

This work applies the Multiple Factor Analysis (MFA) as an exploratory methodology to analize the indicators of the education´s management that belong to 32 Colombian public Higher Education Institutions (HEIs) along the year 2013.

The product of this work indicates that the majority of HEIs have similar structures, being different and better scored the following: La Universidad Nacional (UNAL), Antioquia (UDEA), Nacional Abierta y a Distancia (UNAD), Pamplona y del Valle. Also the UDEA has a high development in extension, formation, capacity and research which is considered one of the best HEIS in the country. The university of Valle has a high degree of welfare, formation and extension, besides moderate capacities on research in comparission with the UDEA wich is superior to the rest of the HEIs. Pamplona has too a high level of formation, extension and moderate weflare, research and capacity in relation to the UNAD. It worth to mention that UNAL is the best located on extension. However, it is surpassed by other University (UDEA) because has a better development in some variables associated to research and extension. To finish, there are other HEIs with too many weaknesses on the indicators of the education´s management wich are UFPS Ocaña, Sucre and Pacifico. These universities show certain problems of research, extension and capacity, but fundamentally strong shortcomings in formation and welfare.

Keywords: Multiple Factor Analysis; Education´s key performance indicator; Higher Education Institutions.

1. Introduction

There are some challenges inside in the higher education institutions (HEIs), the actions and strategies that they must face to mobilize the resources and sources of financing are exhaustive but necessary for reach goals, It must go through for the determination and priorities of certains variables in each HEI, in order to achieve a sustainable financing that allows the expansion and diversification of the education system as also improve the quality in higher institutions.

In this order of ideas, the development of HEIs is undoubtedly amazing and leading a good place among the challenges of higher education in Colombia. The public policy of the actual government is focused on considering education as the fundamental axis of economic and social development, which implies the need to adequately allocate resources in a way that guarantees compliance with the mission and substantive functions of HEIs. That is, Teaching, Research and Extension.

As a result of the agreements between the Ministry of National Education from Colombia (MEN) and the "Sistema Universitario Estatal" (SUE), since 2003 a series of indicators education´s management are defined and make bases for the distribution of resources model, which constitute an one capacity index and four results index from SUE. These five groups, as they will be referred to below, are made up of a series of variables associated with each dimension.

As in this case, in many research contexts it is common to find situations when an observation group is described in terms of several categories of variables. This structure can be hidden when a global analysis of the information is made. So, the Factor Analysis consider different groups of variables in a single analysis, that mean, without considering the existence of variables of a different nature. However, a more ambitious analysis must take, treat and analyze the information in terms of multiple tables, not limited to the search of relationships between variables or the characterization of individuals, in contrast to it should be extended to a comparative analysis that consider the present realities within in each tables and the relationship between tables of different nature.

The reach of this work is to study by the Multiple Factor Analysis (MFA), multiple table analysis technique, the conduct of the HEIs according to their development along the year 2013 in each variable groups and the relationships between these groups (categories or dimensions) and the relations with HEIs.

This technique was developed by the Professors Brigitte Escofier and Jérôme Pagès at the French School of Data Analysis (Escofier & Pagès, 1992). Wich that since its inception has established itself with great versatility with the treatment of information of three dimensions.

There are many research it can be refer to, such as the study realized by Næs, Berget, Hovde, Ares, Varela (2017); Tomic, Berget, & Næs (2015); Vitelleschi and Chavasa. (2015), manifesting its potential in the theoretical and empirical field and many areas. These works reveal how the (MFA) is a multiple table analysis technique with a whole philosophy of comparative analysis too, both graphically and through numerical indicators, of different data sets.

2. Sample

The information used in the present work corresponds to the 29 indicators of the education´s management from 32 Colombian public universities belonging to SUE, for the year 2013. These indicators reflect the different dimensions of development of HEIs, that is, Capacity, Education, Research, Welfare and Extension, participating as active variables in the present study.

The study is carried out on the standardized variables so that the variables, which are measured in different units, can be comparable.

A multivariate outliers analysis was carried out using the Mahalanobis distance, the results indicate the non-existence of outliers.

Table 1 shows the 32 Colombian public universities (HEIs) considered in the study.

Table 1. Universities in study

HEIS	HEIS
Univ. Nacional de Colombia (UNAL)	Univ. del Atlántico
Univ. Pedagógica Nacional	Univ. del Valle
Univ. Pedagógica y Tecnológica de Colombia (UPTC)	Univ. Industrial de Santander (UIS)
Univ. del Cauca	Univ. de Cartagena
Univ. Tecnológica de Pereira	Univ. de Nariño
Univ. de Caldas	Univ. del Tolima
Univ. de Córdoba	Univ. del Quindío
Univ. Surcolombiana	Univ. Francisco de Paula Santander (UFPS)-Cúcuta
Univ. de La Amazonía	Univ. Francisco de Paula Santander (UFPS)-Ocaña
Univ. Militar Nueva Granada	Univ. de Pamplona
Univ. Tecnológica del Chocó	Univ. del Magdalena
Univ. de Los Llanos	Univ. de Cundinamarca
Univ. Popular del Cesar	Univ. de Sucre
Colegio Mayor de Cundinamarca	Univ. de La Guajira
Univ. del Pacífico	Univ. Distrital
Univ. de Antioquia (UDEA)	Univ. Nacional Abierta y a Distancia (UNAD)

Source: Own analisys

Instead, the table 2 shows the 29 indicators of the education´s management associated with each of the 5 categories.

Table 2. Study variables and their codification

Group	Variable/Codification
GROUP 1: Capacity	Teachers equivalent full time / DTCE
	Administrative staff expenses / GPA
	Financial resources / RECFIN (COP)
	Square meters / Mt^2
GROUP 2: Formation	Number of undergraduate programs / NPROGPRE
	Number of Postgraduate Programs / NPROGPOST
	First year enrollment / MATPRIMER
	Undergraduate enrollment / MATPRE
	Postgraduate enrollment / MATPOS
	Undergraduate graduates / GRADPRE
	Postgraduate graduates / GRAPOST
	Saber Pro Tests in English / SABING
	Saber Pro Tests / SABPRO
	Employability / EMPLE
	Colombian students mobility abroad / MOVESTCOL
	Foreign students in mobility in Colombia / MOVESTEXT
GROUP 3: Research	Research groups recognized by Colciencias / GRUPOS
	Indexed journals / REVISTAS
	Articles published in indexed journals / ARTICULOS
	Patents / PATENTES
	Teacher mobility / MOVDOC
GROUP 4: Extension	Students in extension activities / ESTEXT
	Contracts with organizations / VINENT
	Licensed products / PROLIC
GROUP 5: Welfare	Socioeconomic support in undergraduate / APSEPRE
	Socioeconomic support in postgraduate / APSEPOS
	Students Withheld / RETENIDOS
	Health programs / PROSAL
	Student approval rate / TAPRO

Fuente: Ministry of National Education from Colombia. COP: Colombian Pesos

3. Results

3.1. Bartlett's Test of Sphericity

The Chi-Square value of the Bartlett's Test of Sphericity is with 1,796.935 with 406 degrees of freedom and $p - value < 2.11 \times 10^{-16}$, indicating that the data matrix is adequate for a Factor Analysis.

3.2 Weighting of groups of variables

Next in table 3 we show the results of the Principal Components Analysis (PCA) for each group for the year 2013, in order to determine the weights of variables of each group.

This table indicates, for example: The first own value of the PCA of each Capacity group is 3,374, therefore the weight for each variable of capacity group is the inverse, 1 / 3,374 = 0.296. The PCA of group indicates that 94.4% of the variability of variables group is explained with two factors.

Table 3. Results of the Principal Components Analysis (PCA) for each group

Group	PCA First own value group	Weighting of group of variables	Variance percentage explained with two factors
Capacity	3.374	0.296	94.40
Formation	8.267	0.121	82.03
Research	4.458	0.224	97.51
Extension	2.107	0.475	94.06
Welfare	3.688	0.271	84.50

Source: Own analisys

3.3. Multiple Factor Analysis (MFA)

To apply the global analysis (MFA) for the year 2013, we found that 2 factors determinate 79.55% of the variability contained in the 29 analyzed variables. Table 4 shows the own values and the variability explained by each of the 2 components.

Table 4. Values of the global AFM

	F1	**F2**
Own Value	4,548	0,654
Variability (%)	69,556	9,995
% accumulated	69,556	79,551

Source: Own analisys

The correlations between the variable and the factor correspond to the ranges of figure 1. The existence of common factors in groups is justified by their correlation. The high correlation of factor 1 is interpreted as a common axis to the five groups, while factor 2 significantly reduces its relation for these groups, being "Extension" the hightest category with this second factor. This table shows too how the factor 1 (F1) is more associated to the variables "Capacity" group followed by "Formation" group "Research" and "Welfare" group.

Figure 1 shows the distribution of factors, which are formed in the first axis by Welfare, Formation, Capacity and Research, while near the second axis there is the Extension group.

Regarding the contribution percentage of each variables group to the factors, we found that 21.3% of the inertia collected by the first factor is caused by the variables capacity group; while 21.07%, 20% and 18.6% is caused by the variables of formation, research and welfare, respectively. On the other hand, this factor explains with 99.1% the dispersion of the different HEISs according to their conduct with the variables capacity group. The absolute contribution is "Extension" wich second factor is 38.5%. The squared cosines indicate the quality of the representation, indicating the quality of the first factor and the variability present in the four groups, not the same for the second factor.
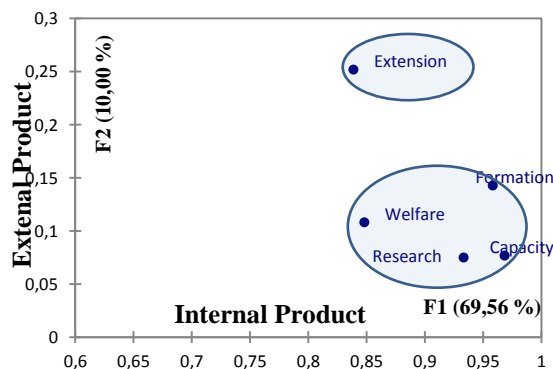
Figura 1: Distribution of Factors. Source: Own analisys.

The Lg coefficients indicate that the Extension group (Lg = 1,12) contains the most heterogeneous variables in relation to the rest of the groups and the most homogeneous are Research (Lg = 1,01) and Capacity (Lg = 1,01), followed by Welfare (Lg = 1.04) and formation (Lg = 1.05).

The RV coefficients are defined as a measure of association between the groups. These coefficients show a strong similarity in the existing structure between the Capacity group with the Formation and Research groups, and between the Formation - Research group and Welfare, that´s mean, there is a high correlation in the groups. Also the Capacity group has the most correlation with the rest, followed by Formation, as indicated by the MFA.

Figure 2 shows the variables representation to its correlation with the factor axes. The arrows indicate the directions of growth of variables in the factorial space, which allows to identify graphically the variables with greater weight in each component. The center of the circle represents of correlations the average of all the variables.

The different variables are mainly correlated depending on the proximity of their vectors, for example, if the angles of these variables approach to zero, they will be more correlated and vice versa. Now, the variable PROLIC forms an angle of 90 degrees with the GPA and with MOVESTEXT, which indicates non association between the firsts with the other two. Regarding the variables group of the Research dimension, we see the highly correlated with each other, except MOVDOC.
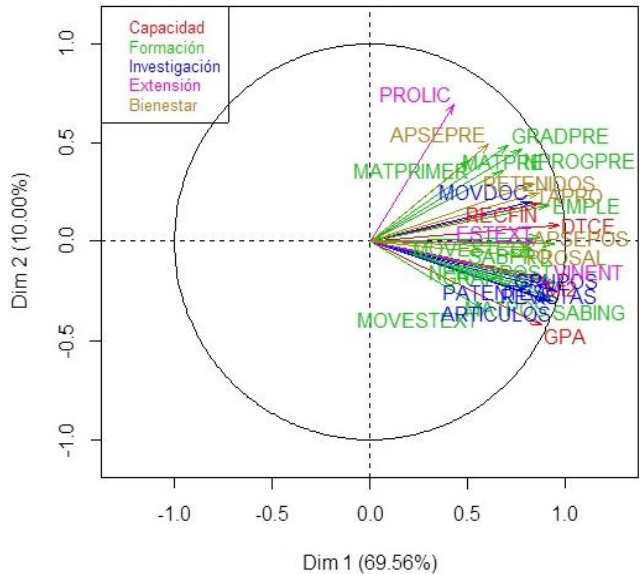
Figure 2: Representation of the variables. Source: personal compilation

The MFA allows to project in a factorial plane (1,2) the 32 HEIs and describe their conduct according to their ranges (figure 3). For this, we understand the greater development of HEIs, their formation, capacity, research and welfare, as they move to the right of the plane, more development in their licensed products, links with entities and students in extension activities. In this way, two HEIs can have the same behavior with respect to an axis (internal product) such as Pamplona and Militar and the factor comprised by formation, capacity, research and welfare, however, have a different behavior with the second axis "product external".

The UNAL has the best development in capacity, research, welflare, but low standing in Extension, while the UDEA growth in the plane, being the second HEIs with the best development in capacity, research, welfare but first in extension. Besides, the universities of the Pacific, Colegio Mayor de Cundinamarca, Amazonia, Sucre, UFPS Ocaña and Nariño present similar characteristics and at the same time a low standing. So in general terms we can interpret figure 3 depending if similar HEIs be close to each other.

Figure 3 also allows us to visualize the structure and similarity of the HEIs under analysis. As can be seen, the majority of this institutions have the same structure, with some differences like a (UNAL, UDEA, UNAD, Pamplona and Valle). Now, the strengths / weaknesses of each IES can be analyzed, as in the case of the UDEA, which has a high degree of development in extension, formation, capacity and research, considered one of the best among HEIs. The graph shows too some vectors of capacity and research that are not as strong as extension and welfare. In the case of the Valley, the degree of welfare, formation, extension, capacity and research are high in relationship with the UDEA but superior to the rest of the HEIs. Pamplona has a high level of formation and extension, but moderate welfare, research and capacity in relation to UNAD.

With respect to UNAL, we can indicate it how the best located in the axis 1 (internal product), however when it compared with the rest of the HEIs, it is surpassed by the UDEA due to its better performance in the variables of the extension groups and welfare.
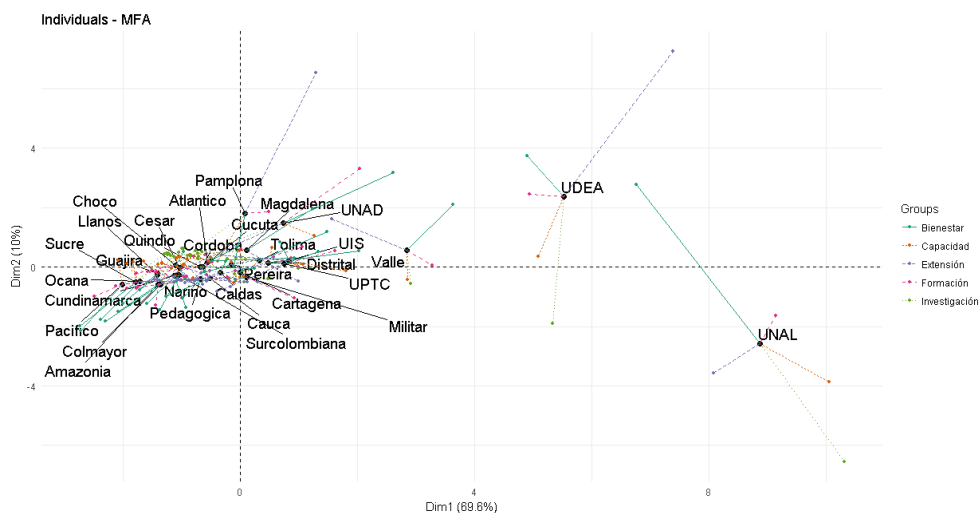
Figure 3: Representation of HEIs with their categories. Source: Personal compilation.

The HEIs that exhibit the most weaknesses (third quadrant) are the Universities of the Pacific, Colegio Mayor de Cundinamarca, Amazonia, Sucre, UFPS Ocaña, Chocó and Nariño. Of these, the Universidad del Pacifico is the one with the lowest development. These HEIs must greatly improve the variables of the formation, especially the universities of the Pacific and Colegio Mayor de Cundinamarca. For its part, the University of Chocó is the one that presents a better standing in the Welfare and Extension groups. Regarding the variables of the Research group, all these universities have a similar profile (quite poor), a similar situation is presented with the Capacity group. The University of Nariño lead in some variables such as Capacity and Research group. In general terms, all these HEIs must make a great effort to greatly improve all management indicators.

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Is the Italian student survey on teaching reliable? For what purposes?

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Abstract

Italian universities submit a compulsory survey to students for the evaluation of teaching activities. The questionnaire, designed by the Italian National Agency for University and Research System Evaluation (ANVUR), aims to evaluate four dimensions of teaching quality (course, instructor, personal interest and overall satisfaction) through twelve questions on a four-level scale. This paper addresses first the issue of the questionnaire's reliability in the representation of the four evaluation dimensions. The main result is that the questionnaire do not represent properly the four dimensions of evaluation which it is intended for. Secondly, through a preliminary statistical analysis, it discusses the use of the survey for comparative purposes. A comparative analysis can be adversely affected by several contextual and subjective factors, like the size of the class and the gender of the instructor. The paper concludes by discussing the difficulty of finding proper conditioning, and raises doubts regarding an uncritical comparative use of student evaluations of teaching activities.

Keywords: Teaching assessment; Students surveys

1. Introduction

Since the introduction of the national system of quality assurance, Italian universities have been obliged to submit to students an evaluation questionnaire for all teaching activities (courses, lab lesson and other activities run in the classroom). The basic structure of the questionnaire is defined by the National Agency for University and Research System Evaluation (ANVUR) (ANVUR, 2013).

The results of the survey are used differently by different universities. Some choose to make all the results for each teaching activity or each instructor public, while others present their results aggregated by degree only. Moreover, there are cases in which results are used in incentive schemes or are used to evaluate promotion and tenure.

After some years of widespread collection of data, it is consequently of the utmost importance to answer questions such as: 1) What is the value of the information in the current questionnaire? 2) What use could there reasonably be for the results, and in particular, 3) Is it possible to make individual comparisons aimed at orientating students' choices or official board decisions on tenure, promotion or incentives?

To this aim, this paper uses surveys collected from students at the University of Trento who attended between 2013 and 2016. The questionnaire seems only partially able to represent the dimensions of evaluation for which it was designed. Moreover, we raise doubts on their comparative use for the purposes of student orientation and faculty policies. Without a valid set of controls, comparisons between courses activities and teachers can be strongly biased. Instead, the survey can be an invaluable tool for self-assessment and teaching quality enhancement.

The paper proceeds as follows. First, it presents the current survey and the dataset. Then, in Section 3, an analysis of the questionnaire's reliability is conducted. Section 4 offers some hints on the interpretations of the students' assessments of the teaching activities. The concluding section draws upon several consequences for the use of the survey.

2. The Italian survey assessing the quality of teaching activities

Prior to 2013, several Italian universities independently carried out surveys on students' evaluations of teaching activities and instructors. Since then, ANVUR has issued guidelines for quality assurance, including the compulsory introduction of a survey of students' teaching evaluations, as well as a common framework for the questionnaire. ANVUR proposes two questionnaires; one submitted to attending students, and the other to non-attending students. (In Italy attendance at lessons is not compulsory).

The compulsory set of questions proposed by ANVUR is presented in Table 1. Answers are given on a four-grade scale: completely negative, rather negative, fairly positive and completely positive. At the end of the questionnaire, an open field is dedicated to free comments. Universities are free to add further questions. They can also decide how to submit the questionnaire to students—whether to make answering compulsory and whether to collect it in-class or online—and how to publish results, either aggregating them by degree or showing in detail the scores for individual teachers.

Table 1. List of questions (attending students)

Question Code	Question
D01	Was your preliminary knowledge of the course topics sufficient for your understanding of the course?
D02	Is the workload reflected proportionately in the number of credits the course offers?
D03	Is the teaching material (as presented and made available by the teacher) suitable for studying the topic?
D04	Are the assessment methods clearly defined?
D05	To what extent were the class schedules and other learning activities respected?
D06	Is the teacher able to stimulate/motivate interest towards the subject of the course?
D07	Does the teacher explain the subject in a clear manner?
D08	Are the integrative didactic support activities (tutoring, lab sessions and testing) useful to better understand the subject?
D09	Is the course content consistent with the course presentation as described in the syllabus published on the website?
D10	Is it easy to contact the teacher to obtain further explanations and clarifications?
D11	Are you interested in the subjects taught during the course?
D12	On the whole, are you satisfied with this course?

What follows, is a discussion of the use made of the questionnaires collected among attending students between 2013 and 2016 from the University of Trento. At this university, the survey is conducted online through the digital platform for student services. A student can fill out the questionnaires two thirds into the term and before registering for the exam. Then, they state whether they are an attending or non-attending student. Subsequently, the form is opened and the student completes it. Despite being available from two thirds into the term, the vast majority of students fill out the form immediately before registering for the exam.

The dataset employed consists of 274,000 questionnaires collected between 2013 and 2016 in 6,900 instances or combinations of teaching activities, instructors and years. The same teaching activity could indeed be performed by more than one instructor, and the same instructor was usually involved in more than one course (or other teaching activity).

Unfortunately, due to privacy regulations and with the aim of offering the full assurance of the respondents' anonymity, individual identifiers were automatically eliminated. It is thus impossible to link answers to individual characteristics and information on the students' former careers. This strongly limits the scope of the analysis.

3. Questionnaire reliability

ANVUR divides the questionnaire into four groups of items. D01–D04 are about the teaching activities, D05–D10 evaluate the instructor, D11 is about personal interest and D12 is an overall indicator of the student's satisfaction.

From pairwise correlations, it appears that D12 is, in reality, strongly correlated with the answers to questions D06 and D07. Apparently, the overall evaluation of the learning experience, strongly depends on the teacher's skills and competences.

For a first appraisal of the questionnaire, as a tool able to capture the three evaluation dimensions listed by ANVUR (teaching activity, instructor and personal interest and leaving aside overall satisfaction), a principal component analysis (PCA) was conducted. To this aim, D12 (for the reasons just mentioned) and D08, which concerns integrative activities, have been discarded.

Table 2 presents the results of the PCA, performed using a Varimax rotation on the first three components.

Table 2. Principal component analysis of the answers. Rotation: orthogonal Varimax; Rho = 0.6491; Number of obs = 274,127. Variance explained by the first three components.

Component	Variance	Difference	Proportion	Cumulative
Comp1	2.78741	0.615719	0.2787	0.2787
Comp2	2.17169	0.639526	0.2172	0.4959
Comp3	1.53217	.	0.1532	0.6491

The first three components explain approximately 65% of the variance (Table 2). From loading factors, the three retained components are associated to the questions as follows:

- *Component 1*: depends mostly on questions D4, D5, D9 and D10. It can be interpreted as an evaluation of the organisation of the teaching activities (the schedule, the clear definition of the content and the assessment, and the availability of the teacher during office hours)

- *Component 2*: depends on questions D11, D6 and D7, and can be interpreted as the perceived quality of teaching (the clarity of the teacher and the student's interest in the subject)

- *Component 3*: depends on questions D1 and D2. Here, the main point is the relationship between the student and the teaching activity (the adequacy of the background and the perceived workload)

Two conclusions can be drawn from this first part of the analysis. First, the set of questions seems able to give a comprehensive representation of different dimensions of the evaluation. The information added by each question is not negligible (the answers are not strongly correlated). However, the overall appraisal (D12) for a teaching activity evaluation must be used with care, as it is particularly sensitive to a few dimensions of quality. Second, the grouping of questions proposed by ANVUR does not correspond with what emerges from the data. The principal component analysis statistically groups different questions, and the interpretation of components highlights slightly different dimensions of quality evaluation—organisation, teaching and the relative position of the student with respect to the teaching activity—which, according to this analysis, better interpret students' subjective perceptions of quality.

4. At the roots of the students' answers

Students' questionnaires offer useful information to instructors and to the staff in charge of running degree. However, to understand better how to use the results, it is important to determine the sensitivity of the answers to different conditions. This is especially important if students or staff have the goal of comparing teaching performances. To be significantly compared, evaluations must be conditioned to relevant control variables in order to make comparisons between teachers or courses as similar as possible.

Unfortunately, as has already been said, very little information on respondents is available. For this reason, in this section it is possible to give only some tentative assessments of the problems of a comparative use of the observed results.

A first exercise that has been carried out is an analysis of variance. The total variability of answers can be decomposed in two components. The between variance is the variation that can be attributed to the difference among teaching activities, and the within variance is due to the variability of the evaluations among the students attending a given teaching activity.

It is clear that the larger the between component, the more meaningful it is to compare the teaching activities and teachers. On the other hand, if the within variance is large with respect to total variance, students evaluate the same teaching activity very differently.

To this aim, Question D12, which reflects the overall perception of the quality of the teachers and teaching activities, has been considered. The between effect covers only 30% of the standard deviation.

This means that a large part of the difference among the evaluations of teaching activities is due to the ways that participants of the same activity perceive the teaching experience. The underlying heterogeneity may hamper comparability of teaching evaluations (Bertoni et al., 2017). This could be related either to objective factors, such as the class composition in terms of background and former training, or to subjective factors, such as the way that the students interpret the grading scale. Factors such as internal scale, anchoring and recency affect the evaluation and use of grading scales. If there are factors that systematically influence the composition of the classes, and students self-sort in different courses, a comparison between the course evaluations would be extremely problematic.

As already stated, there are no data on respondents that would make this analysis possible. However, as a first step in this direction, it is possible to consider some observable variables within the teaching environment which can influence the perception of quality.

To this aim, we move from the consideration of individual questionnaires to their aggregation by single instances (a combination of a teaching activity, instructor and year). There are almost 6,900 observations of these instances. Each record contains, for each question, the number of answers in the 1–4 scale as well as some additional information.

A linear regression has been run. The dependent variable is the share of the positive answers on the total answers (sum of the fairly positive and absolutely positive answers). The independent variables are: the number of attending students (total of the collected questionnaires); the gender of the instructor; the level of the degree; the distinction between the Bachelor's degree (L), Master's degree (M), and full five-year degree (U); the department; the average grade; and the year.

Table 3 shows the results of the descriptive regression. It can be seen that, as expected, the number of students is negatively associated to the share of positive evaluations. Five-year degrees have a negative impact on the evaluation, while there is not a great difference between the teaching activities' evaluation of the Bachelor's or Master's degrees. The average grade in the class is positively correlated with the evaluation. This is somewhat surprising; students evaluate the activities and teachers before the exam. A positive correlation could result either from the fact that better teaching improves performance, or that the knowledge which students have on the attitudes of the instructor/examiner leads

them to assign higher evaluations to more generous examiners. A similar result is found by Braga et al. (2014:81) which observe that "teachers of classes that are associated with higher grades in their own exam receive better evaluationfrom their students".

Particularly surprising is the effect of gender. Female teachers have significantly worse evaluations than males. Whether this reflects worse performance (due, for instance, to the work overload of women, who are often tasked with family duties more than men) or an effect of stereotyping could be a matter of discussion.

Table 3. Linear regression model for the share of positive evaluations (fairly positive plus absolutely positive answers over total answers

Dependent variable: share of positive answer to Q12	Coef.	Std. Err.	t	P>|t|
Ave.Grade	0.001237	0.000356	3.47	0.001
N. Students	-0.00044	5.17E-05	-8.45	0
Instructor's gender (base: F)				
M	0.020165	0.00462	4.37	0
Degree level (base: Master)				
B	0.05049	0.01307	3.86	0
U	0.05462	0.012959	4.21	0
Constant	-5.6775	3.567168	-1.59	0.112

5. Conclusions

This paper has shown that the compulsory introduction of a student evaluation questionnaire, proposed by the Italian evaluation agency ANVUR, could be an important tool for quality enhancement. The questions are informative, but the analysis has suggested a different aggregation of questions than that proposed by the agency, as well as a partially different interpretation of some individual items.

In the second part, the paper presented preliminary evidence on the difficulty of a comparative use of student evaluations of teaching activities. They can derive from several subjective perceptions and context conditions which can influence the way students evaluate the activity and the instructor. Without a precise knowledge of the conditioning factors, the analysis suggests that a simple, unconditioned comparison of evaluations presents several risks (Stark and Freishtat, 2014) . The size of the class, the gender of the

instructor and the average assessment score are among the variables that influence student evaluation.

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Accreditation and quality in higher education curriculum design: does the tail wag the dog?

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Abstract

Increasingly, the higher education sector is driven by sets of standards that describe quality – internal institutional standards that consider curriculum, teaching and delivery to students and external standards from both the sector and the professions that describe expectations, content, skills and attitudes that curricula must address to support graduate outcomes. Quality is the focus of these requirements, and yet quality in higher education remains a messy problem, with no clear framework (Kundu, 2016) and numerous variables that confound the problem. We ask what comes first: the external standards that accredit a university to provide education for a profession, or internal standards that focus on quality teaching and learning opportunities. The paper presents a short case study that highlights the challenge for course leaders pressured to meet industry requirements, and the impact this has on their awareness and capacity to design a transformational curriculum for students. We conclude that it is the difference between an aspirational course, whereby quality is focussed on the learning design for transformational student experience, and a compliant course, where quality is focussed on meeting static requirements.

Keywords: *quality; accreditation; curriculum design.*

1. Introduction

In the last decade in Australia, there has been an increasing focus on the quality of higher education in response to the Bradley Review (2008) and to changing community expectations (Lawson, 2015). This reflects the international higher education context where there has also been an increased demand for measuring and reporting quality (Lawson, 2015; Kundu, 2016). The Tertiary Education Quality Standards Agency (TEQSA) is the national body charged with assuring the quality of higher education in Australia. The sector is replete with sets of standards that offer defining criteria for measuring the quality of student learning and experience, teaching, administration and student achievement. As well, Australian universities have been provided with sets of accreditation requirements by the professions that are reflected in course profiles. These have become more formalised over time, and are an important reference point in all curriculum design processes and the driver for professional accreditation, assuring graduates employment in the profession. Since 2015 the Higher Education Standards Framework (HESF) has driven the design, governance and delivery of courses across Australia, ostensibly providing a single set of quality indicators and benchmarks that all institutions must address.

Quality is a vexed concept – both in its definition and in its demonstration as dependent evidence that meets standards, despite the fluidity of the sum of variables, both concrete and ideological that are possible. Across the last three decades, quality has been increasingly measured through frameworks and standards that set benchmark expectations and can be 'ticked off' to provide evidence of quality. These are at both institutional level and program level and have promoted debate around the definition and then measurement of quality in higher education. Successfully meeting the described standards impacts on reputation, funding, marketing and enrolments.

In this paper, through a case study, we explore the relationship between accreditation and quality in the context of curriculum/program design through its impact on those designing a curriculum. *Is the tail wagging the dog?* We argue that depending on accreditation standards may put quality learning at risk. We explore the impact when course leaders feel pressured to meet the needs of their stakeholders and wonder what may be lost in the process. We ask, does this relationship between accreditation requirements and learning design aspirations create a dynamic that assures us of quality, or does it encourage a compliance mindset, with the ticking of boxes being the main outcome?

2. The challenge of seeking quality

While historically education institutions did not enter the industrial debate around quality (Kundu, 2016) there is an increasing amount of literature that engages seriously with the concept of quality in higher education. In a comprehensive literature review Kundu (2016)

cited six definitions of quality in higher education that encompassed a consistency of variables including cost, performance, inputs and outputs and resources. He also identified a plethora of frameworks, approaches and perspectives around quality that led to a conclusion that quality in higher education cannot be fully determined without a common framework, and a greater amount of theorising around the concept of quality. Kundu then offered a framework of defined critical success factors (p. 29-30) which he argued would help to resolve the conundrum.

2.1. External accreditation processes for quality

Harvey and Williams (2010a, 2010b) critically reviewed articles over the lifespan of *Quality in Higher Education* to discern what was being said about issues of quality. External processes and factors were the focus of their first article (2010a) and internal processes the second (2010b). Accreditation is valued despite concerns about its efficacy as a quality assurance process in the HE context. Overall, it was noted that external accreditation did not necessarily lead to quality improvement of curriculum and learning programs. The following points emerged:

- auditing, or reviewing quality against external factors is of benefit at an institutional level but not so much at a program level,

- accreditation standards tend towards fixed statements of expectation and control while quality in education is dynamic and relative, emerging responsively to learners, teachers and research,

- there is a need for a balance between accountability and improvement, between compliance and responsiveness and,

- the growth of agencies with accrediting frameworks that drive the design and development of programs in universities is concerning, and has created a pressure to accredit all aspects of education.

These points are made in the context of increased competition among insitutions and the need to market a product that best meets the needs of the 'customer'. Marketing, and the meeting of demand for international connections are new factors in the design of curricula. The importance of nurturing a reciprocal and open partnership with accreditation agencies or boards, with the profession and with students was highlighted by Jalal, Buzdar and Mhosin (2017) in their examination of the relationships between accreditation boards and university academics. They found that the stronger the relationship, the more successful the sharing of quality expectations and related changes. Transparency of design and cognizance of the professional world provide opportunity for curricula to connect with the needs and demands of the professions.

2.2. Internal accreditation processes for quality

The reality of the quality-intense context outside of universities impacting on what happens inside the institution has not always been met with enthusiasm by those in the academy who question the intrusions of quality assurance measures into their autonomy and academic freedom (Harvey & Williams, 2010b). Harvey and Williams could not confidently say that there was confirmation that quality assurance systems had enhanced the sector.

Quality processes and assurance systems internal to the individual universities and developed by individual universities were described in the journal articles to be:

- a burden on top of other workloads,

- rituals that were not part of regular academic activity and that challenged the link between intention and practice,

- intrusive and critical, imposed by administration for reporting,

- unsupported by professional development and so contributing to stress,

- bound in measures of student performance and success without acknowledging the impact of student history and capabilities, and

- coloured by the inclusion of student measures of satisfaction that included service factors as well as teaching factors.

While there were facets of teaching that contributed to quality learning (eg professional development, peer review systems, reward and recognition, wellbeing) literature reviewed by Harvey and Williams (2010b) suggested that the measurement of quality in teaching and learning as defined by each institution was not as effective as imagined due to a culture of academic freedom in the faculties. However there are definitions of quality that have been expressed with a focus on teaching and learning. Others (cited in Kundu, 2016) identify student transformation as a measure of quality, describing this as having evidence that students show an increase in their capacity to not only receive knowledge but to produce critical or original perspectives and innovations as graduates.

Harvey and Williams (2010a, 2010b) concluded that while there has been an improvement in terms of transparency, documentation of processes and curricula, and an internalisation and standardisation of quality assurance processes in university environments, there has also been much debate and discussion around the concept of quality. The challenge of defining and measuring quality is not resolved but rather identified as an ongoing question to be pursued.

3. The evolution of a definition of quality: where might it be going?

Before such a focus on sector and institutional quality assurance and the expectation of visible and accountable quality learning in higher education quality was personalised, resting on the individual academics responsible for the units they taught (Thomson, Auhl, Hicks, McPherson, Robinson, & Wood, 2017). The focus of curriculum development was at unit level and an overall curriculum was patched together from a collection of units, with or without a defined pathway through. Such a 'jigsaw puzzle' (Thomson et al, 2017) approach led to idiosyncratic and diverse experiences for students that posed a risk to quality offerings. Concomitantly, each institution offered its own approach to the design and structure of its curricula steeped in their culture and thus providing students with a unique learning experience towards graduation. The process of learning in higher education was perceived as being the gathering of information from those in the role of expert and reproducing it in order to perform in a profession (Frenk, Hunter & Lapp, 2015). A curriculum was not defined but rather emerged as the student moved through their time of study.

In more recent times exponential change has occurred in most fields and professions, and in the scholarship of teaching and learning in higher education. Complexities including globalisation, the online world of knowledge and expertise, messy and unpredictable problems in all fields and the speed of technology development play out in the design of curricula that produces graduates able to perform in such a world (Frenk et al, 2015). Graduates need to be able to 'untangle vast amounts of information and extract and synthesize the knowledge necessary for population-based decision making' (Frenk et al, 2015, p. S110).

More complex learning and social environments create an imperative that academics improve and develop their teaching and work in a more collaborative way to design curricula that are pedagogically diverse and relevant in the current climate. There is a risk to quality teaching when academics are not provided with specific development of teaching skills and understanding (Harvey & Williams, 2010b). Such pressures in environment and expectation sit alongside the quality driven context where quality remains a central tenet for employment, funding, marketing and aspiration.

4. Curriculum design as the foundation of quality programs

Frenk et al (2015) argued that quality higher education into the future must adapt to meet the needs of the political and industrial context. They described a renewed process of whole-of-curriculum design driven by the challenges of the current education and professional context and quality expectations. Its five principles focused on connected curricula offering deep and surface learning, flexibility to allow personalised pathways and aspirations to

offer students levels of learning from foundational, formative to transformative learning. They aspired to meet both the external standards required in the profession of their graduating students and a set of internal standards driven by an institutional requirement to raise the valuing of teaching for all academics in a culture that required a balance between research and teaching.

Similarly, in the quest to be assured of quality in student learning, Lawson (2015) proposed a whole-of-curriculum design process that demonstrated connections between units focussed on student assessment and its alignment to the course learning outcomes, and scaffolded learning and connectedness across units. The process relied on shared understandings of the course learning outcomes and a preparedness to explore how the teaching in each unit contributed to the student development, and linked to earlier and later learning. The whole of course design was completed before the work on individual units.

Thomson et al (2017) described a design based on collaborative, outcomes based curriculum development. The process integrated the standards of the profession with university sector standards to inform the course learning outcomes. It then followed a process of establishing what students need at graduation and then working backwards to design the curriculum to meet these needs. Key to the process was the collaboration that brought together the course team to design a curriculum that was scaffolded, aligned and purposeful.

Quality curriculum design was the focus for these authors. Designing curricula is a process of the field of education and while accreditation standards can influence the decisions about content and skills and have led to improvement in the quality of learning in higher education (Harvey & Williams, 2010b) the challenge remains in terms of what comes first – an aspiration for quality learning in response to the scholarship of learning and teaching, or a compliant curriculum that meets the requirements of a profession?

5. The case study

In this section of the paper we present a short case study that illustrates our question.

5.1. Context

Our university is set in a dispersed regional setting across nine campuses in

Australia. It aspires to meet the needs of the communities where it is located and to provide employable graduates who will move into the regions and support the professions locally. There is a commitment to offer quality learning in a regional context. As an Australian self-accrediting university it must demonstrate how it assures the quality of the teaching and learning it provides to TEQSA. As a self-titled 'university of the professions' it is imperative that the courses also meet the set of quality indicators and expectations for each profession

served by its profile to achieve professional accreditation. This has led to a situation where course academic leaders are highly accountable for courses achieving accredited status with the external group, and less overtly pressured to consider the quality of the learning design.

5.2. The Case

During 2018, nine programs underwent the CSU course design process. The courses were long standing courses on the university profile that have been accredited consistently for a number of years. There was considerable pressure to meet the accreditation standards set by the relevant accreditation agency. All nine of the courses under review were required to meet the same set of standards. The design process began with an analysis of the context for the degrees, the areas of risk evident in the course, the feedback and professional responses to the course, and an analysis of the needs of the profession. This was followed by an integration of the sets of standards that drive the courses: those from the profession, the CSU graduate attributes and Australian Academic Qualification Framework (AQF) standards into a single set that translated to course learning outcomes. Following this, the design team considered the assessment outputs that would provide evidence of addressing the standards across the course. From this, unit level assessments were either constructed or adapted from existing tasks, and unit outcomes, teaching and learning strategies and syllabi were developed. Using CourseSpace, a bespoke design tool, alignments were constructed and the course was then reviewed for its design; a matrix of accreditation standards was drawn out based on the alignment.

During this process of review it became obvious that there were two different approaches to the process in the community of course leaders involved. All course leaders were well experienced academics with a long term involvement in the profession; the supporting learning design experts had considerable experience in both spheres. The first approach was highly dependent on the language and detail given in the accreditation documents, and time was spent analysing where the evidence was, and constructing descriptions, tasks and outcomes that mimicked the style and wording of these documents. The leaders did not deeply engage in the initial phase of design/review, expressing high levels of anxiety around the professional accreditation requirements that would be found in units. Little time was left for alignment mapping or a course level view of the way the subjects worked together to transform student understanding of teaching and learning. The second approach was more holistic with an eye kept on both the standards expectation and equally on what it meant for student experience. These leaders focussed on the way assessment offered authentic experience, how concepts were learned across the course with increased complexity and what some of the 'big picture' understandings were to support student growth. The defining of evidence to meet the course learning outcomes was deemed as important to present a picture of how students would develop across the course. Mapping to the accreditation requirements happened as the work was done, but without undue pressure to replicate the

standards in language or format.

The salient learning in this case study was in the impact quality expectations had on the course leaders and the trust they placed in their own experience. Those following the first approach spent many hours reviewing, amending, checking and adjusting the language and descriptions in the individual units in the course. They had little time for educational leadership, consultation with teaching academics or to overview the course as a whole. Those utilising the second approach maintained a holistic picture of the course, led the team through changes and made fewer adjustments to show where standards were addressed. They appeared more confident to map based on their own expertise. Their experience of quality development was more holistic and enabled them to consider how the course would transform student understanding of teaching.

The case study highlights the impact high dependence on accreditation requirements had on the quality design of a curriculum. It illustrates the following considerations for designing quality curricula in higher education:

- approaching a curriculum design with quality learning in mind requires time to collaborate, listen to different viewpoints, have blue-sky thinking, connect research evidence and challenge status quo,

- trusting experience and research allows future thinking to contribute to the design, rather than simply responding to what is the 'now' in a profession and

- after a quality design process, alignment with standards becomes a cognitive, analytic and creative task that validates the design thinking.

6. Conclusion

This paper explored the relationship between quality and accreditation processes in higher education. From the exploration we believe that if accreditation standards force compliance then the tail is wagging the dog. A compliant program meets the baseline expectations of stakeholders, assuring them that graduates meet their needs but it does not guarantee a program of quality learning experiences. However, if the curriculum designers utilise their expertise, knowledge, skills and integrity to design an intentional program that provides students with the capacity to not only consume knowledge for their future, but to produce new knowledge that brings about change in their future then the dog is wagging the tail. Such a program aspires to change students beyond providing them with base information and skills, resulting in an assurance that they will make a difference in their world, which is an indicator of quality learning.

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Recruitment policies in Spanish universities, a case study: Teaching and research quality

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Abstract

This article analyzes research and teaching quality of the faculty members of the Department of Business Economics of "Universitat de les Illes Balears" (UIB) depending on the origin of their Doctor degree (local or external). This department changed the recruitment policy, from the traditional policy of hiring the own doctorate students to the policy of hiring doctorate students from other universities. Faculty members with an external Doctor degree were recruited mainly in the Spanish Job Market, most of them obtained the Doctor degree in a high-quality doctorate program, and were focused on high-quality research. Taking into account several control variables, such as age and specialization area, we obtain that faculty members with external Doctor degree show statistically significant better research quality indicators, and present no significant differences in teaching quality indicators than faculty members with a UIB Doctor degree. Therefore, we conclude that the recruitment policy of the department increased research quality without hurting teaching quality. This represents an indirect analysis of the relationship between research and teaching quality, showing a strategy to improve one without hurting the other.

Keywords: Recruitment policy; Endogamy, Research quality; Teaching quality.

1. Introduction

Spanish public universities are well known for their recruitment practices, primarily based on endogamy. Usually, individuals develop their academic careers in the university where obtained their Doctor degree. However, the media, and the society, seems to show a consensus against this recruitment policy, as can be seen in articles published in some of the most relevant Spanish newspapers (*El País* 12/9/2016 "*La evolución de la endogamia…*"; *El Mundo* 6/3/2017 "*La comunidad de Madrid…. ley que acabe con…fichen a sus propios alumnos*").

Usually, universities consider research and teaching activities as their main tasks (Labini and Zinovyeva, 2011). Although, those activities could be complementary or substitutive. Research activities allow faculty to reach the frontier of knowledge, and therefore to know what is more relevant to teach to students. However, research activities are time-consuming and faculty members focused on research might spend less time and effort on teaching activities than members focused on teaching. Spanish universities avoiding the recruitment of their own Doctors usually hire new faculty from high-quality doctorate programs and these candidates focus their effort on research activities. Therefore, if research and teaching activities are substitutive, this recruitment policy could deteriorate teaching quality at these universities. However, previous articles analyzing research and teaching quality found mixed results. Rodríguez and Rubio (2016) found a positive correlation and Hoffmann and Oreopoulos (2009) found no relation.

The object of this article is to empirically study whether research quality increases and teaching quality deteriorates when universities hire faculty from high-quality doctorate programs who focus on research activities. We analyze the Department of Business Economics of *Universitat de les Illes Balears* (UIB) from 2009 to 2017. This department changed its recruitment policy more than ten years ago, forbidding explicitly the recruitment of their own doctorate students. Open positions are posted in the Spanish Job market of Doctors in Economics and Business. In this market, the main institutions are business schools, and a few public universities, such as *Universidad Carlos III de Madrid*. Using several control variables, such as age and the specialization area, we analyze whether there are clear differences in teaching quality and research quality indicators depending on whether faculty members obtained their Doctorate degree from UIB. We find no statistically significant differences in terms of teaching quality, and worse research quality indicators for faculty members with UIB Doctorate degrees.

Our research contributes to the literature on the relationship between research and teaching quality, providing further evidence on the complementarity of teaching and research activities, even when we measure teaching quality only with students evaluations. Rodríguez and Rubio (2016) and Hoffmann and Oreopoulos (2009) analyze other aspects in addition to

students evaluations to measure teaching quality given that Weinberg et al. (2010) find that student marks are a relevant determinant of students evaluations. Relevant difference respect to previous articles is that our analysis is through the recruitment process. Furthermore, our contribution is especially relevant to the public debate on the recruitment policies in Spanish universities, providing evidence supporting that forbidding the recruitment of the own doctorate students in order to hire faculty focused on high-quality research does not deteriorate teaching quality, and indeed increases research quality.

2. Sample and empirical measures of research and teaching quality

Spanish universities have quite an autonomy to designate the panel who is going to evaluate candidates of open positions, and this facilitates the implementation of the traditional recruitment policy, hiring their own doctorate students once they obtain the Doctor degree. Defenders of this recruitment policy argue that local candidates have loyalty to and better knowledge of the university and are better adapted to the teaching needs of the university. Usually, these local candidates hold pre-doctoral teaching positions and therefore have teaching experience, many times in theoretical lessons in addition to the practical ones.

The Department of Business Economics of UIB has teaching duties in Financial Economics, Accounting, Management, and Marketing. In these areas, there are a few universities in Spain with high-quality doctorate programs, such as *Universidad Carlos III* or *Universidad Pompeu Fabra* (their students are hired even internationally). These universities do not hire their own doctorate students. There is a Job Market in Spain for new Doctors in Economics and Business, organized by the Spanish Economics Association. Usually, new Doctors from the high-quality doctorate programs participate in this Job Market. Additionally, given that most of the public universities hire their own doctorate students, most of the candidates in the Spanish Job Market are from the high-quality doctorate programs. In this market, universities have access to high-quality faculty candidates, highly focused on research activities, overcoming the research standards of the national accreditation system (mandatory to hold positions in Spanish universities) more focused on the number of articles than on the quality of articles.

In a smooth process, through several years, the Department of Business Economics of UIB adopted the new recruitment policy, posting the new faculty positions in the Spanish Job Market. As a result, the new faculty members are much more research-oriented than the rest of the faculty. In our time sample, from 2009 to 2017, we find local doctorate faculty members (with UIB Doctorate degree) and external doctorate faculty members (with Doctorate degree from another university). Therefore, we are able to compare the research and teaching quality of faculty with local and external doctorate degrees. We analyze only full-time faculty members with a Doctor degree. Table 1 shows the growth of the department

during our sample period, rising from 30 members in 2009 to 43 members in 2017. This table shows the distribution of faculty in areas (accounting, finance, management, marketing), sex, age, the type of contract, and the type of doctorate degree. In 2009 only one-third of faculty members hold a Doctorate degree from another university, it is around 40% in 2017. During our sample period, 5 faculty members without a Doctorate degree (a minority in the department) obtain it form UIB.

Table 1. Characteristics of faulty members

	2009-2010		2010-2011		2012-2013		2013-2014		2015-2016		2016-2017		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Area														
Accounting	7	23%	8	25%	9	24%	10	26%	10	24%	10	23%	72	24%
Finance	10	33%	10	31%	12	32%	11	29%	11	26%	12	28%	89	30%
Marketing	4	13%	4	13%	4	11%	4	11%	5	12%	5	12%	34	11%
Management	9	30%	10	31%	13	34%	13	34%	16	38%	16	37%	102	34%
Sex														
Female	8	27%	9	28%	12	32%	13	34%	14	33%	14	33%	92	31%
Male	22	73%	23	72%	26	68%	25	66%	28	67%	29	67%	205	69%
Age														
20s	0	0%	0	0%	1	3%	1	3%	0	0%	0	0%	2	1%
30s	9	30%	11	34%	5	13%	5	13%	10	24%	8	19%	61	21%
40s	16	53%	16	50%	21	55%	21	55%	20	48%	20	47%	152	51%
50s	4	13%	4	13%	10	26%	10	26%	11	26%	12	28%	71	24%
60s	1	3%	0	0%	1	3%	1	3%	1	2%	3	7%	10	3%
70s	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	0%
Type of contract														
Temporary	4	13%	5	16%	7	18%	7	18%	10	24%	11	26%	58	20%
Permanent	26	87%	27	84%	31	82%	31	82%	32	76%	32	74%	239	80%
Type of doctorate degree														
External program	10	33%	11	34%	14	37%	14	37%	17	40%	18	42%	112	38%
Local program	20	67%	21	66%	24	63%	24	63%	25	60%	25	58%	185	62%
Total	**30**	**100%**	**32**	**100%**	**38**	**100%**	**38**	**100%**	**42**	**100%**	**43**	**100%**	**297**	**100%**

Number and percentage of full-time faculty members of the Department of Business Economics of UIB by specialization area, sex, age (in decades), type of contract, and of doctorate degree for each academic year. Academic years 2011-2012, and 2014-2015 omitted to save space. Data from the internal documents used to plan the yearly activity of the department.

To measure research and teaching quality of faculty we have data on students evaluations and the internal document the university uses to plan the teaching activity of each academic year. The teaching load of each member decreases if she/he achieved relevant goals in research and in teaching activities. Students evaluations are obtained from the Quality Service of the university, and we were able to obtain data only for academic years 2009-2010, 2014-2015, 2015-2016, and 2016-2017.

We measure teaching quality with three alternative indexes. Teaching quality index 1 is computed directly from students evaluations (available only for four academic years). It goes from 0 (globally, is a very bad teacher) to 10 (globally, is a very good teacher). Teaching quality index 2 is computed as index 1, plus 1 if she/he supervised at least a doctorate thesis last year, plus 1 if she/he supervised at least a master thesis last year, and plus 1 if she/he participated in the organization of students mobility programs last year. Index 3 is index 2 without students evaluations. In Spain, the research activity of each faculty member is evaluated every six years by a central government agency. This evaluation is based on the number and quality of journal publications. Additionally, research is mainly funded by

another central government agency, and different teams of researchers compete to obtain these funds. The university uses these data to determine the teaching load of each faculty member. Therefore, we are able to compute the following indexes to measure research quality. Research quality index 1 is measured as the number of six-year periods of research with a positive evaluation, plus 1 if the researcher participates in a funded competitive research project, plus 1 if she/he is the director of the project, plus 1 if the researcher is active in research (the last positive evaluation of a six-year period is within the last six years). We are able to measure whether a researcher is active in research only for the last two years of the sample, therefore this index is larger for active researchers only in the last two academic years. Consequently, we also compute the research quality index 2, that is index 1 except the "being active in research" measure. Teaching quality indexes are positively correlated, as are research quality indexes. However, teaching quality indexes are negatively correlated with research quality indexes, suggesting a substitution effect between teaching and research quality.

3. Empirical analysis

Our main objective is to determine whether there are significant differences in terms of research and teaching quality between faculty members depending on the origin of their doctorate degree (local or external). A simple univariate analysis shows that faculty members with external doctorate degree present worse teaching quality indexes and better research quality indexes (Table 2).

Table 2. Average value of research and teaching quality indexes

Doctorate degree	Teaching Index 1	Teaching Index 2	Teaching Index 3	Research Index 1	Research Index 2
Local	6.4	6.6	0.2	**2.0**	**1.4**
External	**6.8**	**7.2**	**0.3**	0.8	0.6
Total	**6.7**	**7.0**	**0.3**	1.2	0.9
# Obs.	132	132	297	297	297

Average value of the indexes depending on the doctorate degree of faculty members, whether it is local (UIB) or external (from any other university). Teaching quality indexes 1 and 2 are computed with fewer observations since data on students evaluations are available for only four academic years.

However, other faculty characteristics than their Doctorate degree (local or external) may affect these quality measures. Therefore, we use a multivariate analysis, adding control variables. These variables are faculty characteristics, which we are able to measure, that might affect research and teaching quality. First, we consider age, since experience and professional targets of each faculty member may change with age. For example, older faculty may be more interested in consulting services than on research. Consistently, our data reveals lower research quality among the older faculty members (omitted to save space). Our second control variable is a dummy variable to detect faculty members with a permanent position (at

least "Contratado Doctor", with less pressure to publish in academic journals). In our data, permanent faculty obtain better measures in all quality indexes, consistently with these members being successful to obtain a permanent contract. Third, we consider a dummy variable to identify males. For example, Boring (2017) found a negative bias in students evaluation of female faculty. However, in our raw data females obtain better measures in teaching quality and worse measures in research quality. Fourth, we take into account that some faculty members hold academic managing positions, such as director of the department, or dean. These faculty members have less time to spend effort in research and in teaching activities, although their notoriety might affect students evaluation. The university reduces the teaching load of these faculty members, according to the relevance of the position they hold, the maximum reduction is for the members of the executive committee of the university. We measure this control variable dividing the reduction of teaching load of each faculty member by the maximum reduction. We also take into account that the specialization area of faculty members may be relevant for student evaluations (usually students prefer marketing than finance at UIB), and to obtain high values of research quality indexes (e.g., depending on the area there may be differences in the difficulty to publish in academic journals). In our data, marketing faculty members obtain better students evaluations, and management and finance faculty obtain better measures in research quality indexes. Additionally, in order to disentangle the relationship between the quality indexes and the type of doctorate degree (local versus external) we also consider that any faculty member especially focused on research might spend less effort in teaching activities and vice versa. Therefore, our last control variable is the teaching quality index in the empirical models of research quality, and the research quality index in the models of teaching quality indexes. This also allows us to measure the direct relationship between research and teaching quality. Finally, we add year fixed effects in order to control for systematic changes from year to year in our measures of teaching and research quality. We estimate the empirical models with Ordinary Least Squares and robust standard errors clustered by year (Huber, 1967; White, 1980, 1982).

Table 3 contains the estimation of these empirical models when we measure research quality with index 1. Results are equivalent when research quality index 2 is used instead (omitted to save space, available on request). In these models, a dummy variable identifying faculty members with a local (UIB) Doctorate degree is the key explanatory variable. It is not statistically significant in models 1 to 3, where teaching quality is the dependent variable, and show negative and statistically significant coefficients when the dependent is research quality. Therefore, we may conclude that after taking into account the effect of control variables, there are no significant differences in teaching quality depending on the origin of the Doctorate degree, although faculty members with external Doctorate degrees show better research activity.

Regarding the rest of variables, we find no evidence of a diret relationship between research and teaching activities, holding an academic management position is positively related to teaching quality if it is computed with students evaluations (indexes 1 and 2), consistently with a positive effect of their notoriety among students. Age is negatively related to teaching quality, reflecting less effort by the old faculty members. Results also confirm the univariate analysis (omitted to save space) in terms of the type of contract, with permanent faculty showing better results in all dimensions. Faculty who teach finance and management show better results in research quality. Finally, taking controls into account we do not detect any difference in teaching and research between males and females.

Table 3. Empirical models of teaching and research quality

	Teaching Index 1	Teaching Index 2	Teaching Index 3	Research Index 1	Research Index 1	Research Index 1
	(1)	(2)	(3)	(4)	(5)	(6)
Local Doctorate Degree	0.350	0.154	-0.030	-1.280**	-1.303**	-1.344**
	(0.636)	(0.228)	(-0.152)	(-2.088)	(-2.143)	(-2.225)
Research Index 1	-0.166	-0.186	0.022			
	(-1.297)	(-1.086)	(0.328)			
Teaching Index 1				-0.113		
				(-1.256)		
Teaching Index 2					-0.103	
					(-1.077)	
Teaching Index 3						0.092
						(0.336)
Index of academic managing positions	1.272***	1.651***	0.051	0.690	0.717	0.926
	(2.855)	(3.362)	(0.284)	(0.948)	(1.007)	(1.446)
Age	-0.090***	-0.080***	0.011	-0.032	-0.031	-0.009
	(-3.132)	(-3.093)	(1.394)	(-1.364)	(-1.288)	(-0.427)
Permant contract	1.353**	1.398**	0.062	1.498**	1.489**	1.325***
	(2.424)	(2.155)	(0.355)	(2.450)	(2.418)	(2.815)
Marketing	0.842	1.034	0.450	0.556	0.567	0.574
	(1.356)	(1.453)	(1.085)	(1.032)	(1.047)	(1.301)
Finance	-0.260	-0.546	-0.119	0.582*	0.554	0.870***
	(-0.480)	(-1.036)	(-0.884)	(1.810)	(1.653)	(2.740)
Management	0.468	0.309	0.049	0.819	0.798	0.868*
	(0.961)	(0.634)	(0.454)	(1.632)	(1.608)	(1.811)
Male	-0.381	-0.592	-0.028	0.316	0.298	0.390
	(-1.021)	(-1.638)	(-0.301)	(1.285)	(1.166)	(1.611)
Constant term	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
# Obs.	132	132	297	132	132	297
R^2	0.305	0.307	0.155	0.468	0.468	0.480
adj. R^2	0.235	0.237	0.107	0.414	0.414	0.451
F	4.154***	4.906***	3.974***	6.614***	7.178***	7.371***

Empirical models of teaching and research quality estimated with Ordinary Least Squares with year fixed effects on an unbalanced panel data set of faculty members of the Department of Business Economics of UIB. Models 1, 2, 4 and 5 are estimated using teaching quality indexes computed with students evaluations, available only for academic years 2009-2010, 2014-2015, 2015-2016, and 2016-2017. The rest of models are estimated with data on academic years from 2009-2010 to 2016-2017. Local Doctorate Degree is a dummy variable identifying faculty members who obtained their doctorate degree fom UIB. Permanent contract is a dummy variable identifying faculty members with a permanent contract. Marketing, Finance, and Management are dummy variables identifying the specialization of faculty. Male identifies male faculty members. t statistics in parenthesis, computed with Huber-White robust standard errors clustered by year. F is a test of the joint statistical significance of all explanatory variables. * means statistical significance at 10% level, ** at 5% level and *** at 1% level.

4. Discussion and conclusions

This study contributes to the literature on the relationship between research and teaching quality in universities. While Rodríguez and Rubio (2016) found a positive relationship, Hoffmann and Oreopoulos (2009) found no relation. Both use a measure of teaching quality based on more teaching measures than students evaluations. We analyze the relationship between research and teaching quality through the analysis of the quality of faculty members depending on the origin of their Doctorate degree (local or external) since those with external Doctorate are more focused on high-quality research (overcoming the national accreditation system, which fixes the minimum research and teaching requirements to be able to obtain any position in Spanish universities). With this analysis, we find no negative relationship between research and teaching quality. Faculty members with external Doctorate degree do not show lower teaching quality, although show better research quality, even when we measure teaching quality only with students evaluations. Additionally, we find no significant direct relationship between teaching and research quality. Our results are relevant for universities and for regulators who consider the possibility forbidding the incorporation of own former doctorate students as faculty members. Our results suggest that this policy might promote research quality of Spanish universities without a cost in terms of worse teaching quality.

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Analysis of the speech act of request in the foreign language classroom

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Abstract

Nowadays, teaching languages for specific purposes, in particular in the field of entrepreneurship, has to focus on pragmatic and intercultural aspects in response to a multicultural professional reality that comprises different areas of knowledge. Our study aims at analyzing the speech act of making a request in German and Spanish by Portuguese native speakers, i.e. BA students of Languages and Business Relations at University of Aveiro. For this study, two different types of tests were performed: the Discourse Completion Task (DCT) and the Rating Assessment Test. The data provided by the answers given to these two surveys will help the teacher to understand the pragmatic difficulties students have when making a request in these two foreign languages. The information obtained will help the teacher to focus on aspects that are really problematic from the pragmatic point of view, and at the same time, to find and implement strategies and activities that help students improve their pragmatic awareness and overcome difficulties that may arise in intercultural communication. Hence, the objective is to contribute to an adequate development of the students' pragmatic and intercultural communicative competence.

Keywords: intercultural pragmatics; intercultural communicative competence; speech act; teaching; foreign languages.

1. Introduction

Since the last decades of the last century intercultural pragmatics has attracted the interest of many experts and professionals in teaching, especially in the area of languages for specific purposes such as Business Studies and Economics, where a misinterpretation of a gesture or a word can cause misunderstandings or problems in international trade relations. This study, therefore, falls within the area of intercultural pragmatics, whose relevance to the teaching/learning of a foreign language is undeniable, since it contributes to avoid misinterpretation in the communication between sender and recipient. A pragmatic perspective on language teaching is, therefore, essential to study how verbal and non-verbal messages are produced and interpreted in different languages.

2. The speech act of request

The theory of speech acts is based on the studies of Austin (1962) that proposed a classification between locutive, illocutionary and perlocutionary acts, a theory that was later reformulated by his disciple Searle (1969). The speech act of making a request belongs to the group of illocutionary directive acts which consist of "attempts [...] by the speaker to get the hearer to do something. They may be very modest 'attempts' as when I invite you to do it or suggest that you do it, or they may be very fierce attempts as I insist that you do it "(Searle, 1976, p.11). Brown & Levinson (1987, p.65) designate requests as "face-threatening acts", that is, "those acts that by their nature run contrary to the face wants of the addressee and / or the speaker". Since the requests seek to influence the interlocutor, they represent a threat to the negative side of the listener who may consider that request an invasion of their freedom and their right to self-determination. One way to mitigate the request is through conventionally indirect strategies, on the one hand, and not conventionally indirect, on the other. The first case considers strategies that create contextual preconditions through the use of conditional forms (*Poderia ajudar-me?*), while in the second case the request is partially or totally omitted and replaced by a suggestion that refers to the context in which the communicative interaction occurs (*Entramos numa sala e dizemos ao colega que está mesmo ao lado da janela: Aqui está muito quente*). According to Blum-Kulka and Olshtain (1989) the speech act of the request may be constituted by the *address term*, by the *head act* or by *adjuncts* (or supporting movements). The alerters serve to capture the attention and guide the interlocutor to what they will ask next. Among the alerters stand out the proper name, titles, appeals, compliments, etc. They may also appear combined in the same act of speech. The head act is part of the sequence that serves to make the request and can vary according to the strategy used or the perspective. The strength of the request can be attenuated or intensified through internal modifiers of the nuclear act, such as courtesy markers (*se faz favor*), adverbial modifiers of time, mode and quantity (*imenso*, *um pouco*), consultative structures (*importa-se de*) , conditional sentences (*queria saber se*), etc. Finally, the support movements

have the function of preparing the listener for the request, through mitigators as justifiers or preparers.

3. Methodology and target group

The study presented was carried out at the University of Aveiro with a total of 44 students (20 German students and 24 Spanish students) of the 3rd year degree in Languages and Business Studies. The results obtained and analyzed offer data that serve as a basis for the creation of didactic materials and activities to deal with pragmatic aspects in language classes. It is intended that students achieve an appropriate pragmatic competence, which will influence the development of an intercultural communicative competence. To achieve this goal, we subjected students to two types of surveys:a) Discourse Completion Task, which "consists of incomplete discourse sequences that represent socially differentiated situations. Each discourse sequence presents a brief description of the situation, specifying the setting, the social distance between the interlocutors and their status relative to each other, followed by an incomplete dialogue" (Blum-Kulka, & Olshtain, 1984, p. 198); b) Rating Assessment Test that confronts students with concrete situations in which they have to evaluate communicative interactions in a level scale that goes from not appropriate to appropriate. "The use of scaled-response items for instrument development - is particularly noteworthy because in studies using any kind of data-elicitation format [...] researchers need to know how to respond to the context variables built into the stimulus situations" (Kasper & Rose, 2002, p. 100). According to Martínez-Flor & Usó-Juan (2011) this test serves to obtain data for the evaluation of the students' level of pragmatic competence and to activate their pragmatic awareness. Although this type of questionnaire is not as widely used as others, it is a useful tool to complement the DCT, which provides additional information about the students' meta-pragmatic level.

Studies in this area have already addressed the advantages of DCT (Kasper & Dahl, 1991), which helps to identify essential nuclear situations for the performance of a speech act, as well as to analyze internal and external factors of the communicative context. For our study we chose these two surveys since both are a very useful resource to compare and contrast a concrete act of speech. Despite the fact that both surveys are conducted in writing, which can affect the spontaneity of the discourse, we consider that the information obtained can contribute to identify critical incidents and improve the process of pragmatic awareness of the students.

4. Analysis of the corpus

For this study we used the two types of surveys mentioned above, in which we included communicative situations in different contexts in order to evaluate the students, on the one hand, and to complete the discourse, on the other. Regarding the DCT, our intention was to observe how students perform the speech act of making a request in Portuguese, German and Spanish. In this way, it is possible to observe, among other aspects, the extent to which students are aware of the differences involved in the various linguistic-cultural systems under analysis.

The Rating Assessment Test is for students to evaluate different common everyday situations of the foreign language / culture. The results obtained from this survey constitute a work base for the teacher, since they offer data about the level of students' meta-pragmatic awareness, which together with the DCT allows us to analyze how students value the situations presented. Firstly, we will look at the analysis of the results obtained through the DCT, which included communicative situations in the context of work, on the one hand, and in day-to-day contexts outside the scope of work, on the other. For the latter case, one of the situations presented consisted of asking for directions to someone unknown in Portuguese. It can be observed that the students preferred the use of elements that attenuated the request (alerters, internal modifiers), so that the request was presented in a more indirect way. All the answers contained alerters like greetings (*olá*, *bom dia*, *boa tarde*, etc.), different ways to get attention (*peço desculpa*, *desculpe*, etc.) or the combination of several alerters like (*olhe, desculpe*; *boa tarde, desculpe*, etc.).

The nuclear act is carried out from the point of view of the listener and shows deference to the interlocutor when asking him about the commitment to perform the act that is requested (*sabe-me dizer*, *pode dizer-me*, *poderia indicar-me*, etc.). The request is, therefore, made through conventionally indirect structures, namely questions about the preparatory conditions for the performance of the speech act by the listener. The internal structure of the nuclear act is also characterized by the use of syntactic mitigators such as the conditional (*poderia*, *saberia*) or the imperfect tense (*podia*), although it emphasizes a preference for the use of the indicative present, besides attenuators or lexical mitigators as the politeness marker *por favor*, *se fizer favor*, etc. At the same time, we found external or support modifiers that refer to the context of the interaction, mitigating the illocutionary force as we can observe in the following examples: *Como faço para chegar ao centro da cidade?* or *Estou perdida e preciso de chegar ao centro da cidade*. In the latter case, a justification is used to mitigate the claim. This is an effective mitigation strategy that conveys an attitude of empathy towards the interlocutor indicating the reasons for the request. In another situation the students had to complete a speech act by placing an order in a café. In this context, the productions made were very similar to the previous ones because of the preference for the conventionally indirect way of ordering (*Bom dia, queria, por favor, um café e um pão com manteiga*; *Bom*

dia, queria um café e uma nata, se faz favor). Only on two occasions out of 44 results obtained, the request was made from the listener's point of view, and not from the speaker's, in a more direct way by recourse to the imperative, which emphasizes the illocutionary force, clearly visible in the following example: Boa tarde, dê-me, se faz favor, uma empada e um sumo de laranja. Muito obrigada. To mitigate this most direct request a courtesy marker is used (se faz favor), followed by a mitigator of gratitude. The use of alerts and mitigators conferes a high degree of negative courtesy to the request, since the combination of all these elements aims to reduce a possible conflict between the partners. The students participating in this study also completed the same survey for Spanish and German, respectively. It can be observed that the productions made in the two languages show a similar structure to those made in Portuguese, which reveals a direct transference of the mother tongue. In addition, we can highlight the use of a reduced number of strategies by employing the same alerters as greetings (Buenos días, Guten Tag), attention grabbers (Perdón, Entschuldigung), syntactic mitigators (Podría, Puede, Können/Könnten Sie) and a courtesy marker (por favor, bitte). The request is made in a conventionally indirect manner, thereby attenuating the illocutionary force of the speech act:

> *Por favor, ¿me puede/podría decir dónde es el centro?; Perdón, por favor, ¿me podría decir por dónde se va al centro?; Guten Tag! Entschuldigung, ich möchte wissen, wo die Universität ist, bitte? Entschuldigung, können/könnten Sie mir sagen, wo die Universität ist?*

In the specific context of making a request in a café, in the case of German and Portuguese we observe that the productions show a preference for the use of indirect structures, which does not apply to Spanish. Here we have noticed the use of direct strategies through the expression *quiero pedir*, realized from the perspective of the speaker being, however, attenuated by the courtesy marker *por favor*, by an alerter in the form of compliance (*Buenas tardes*) and also by a mitigator of the force of the request as, for example, *muchas gracias*: *Buenas tardes, quiero pedir una coca-cola y un bocadillo de jamón serrano, por favor, muchas gracias; Buenos días, quiero un bocadillo de jamón serrano y una coca-cola, por favor. Gracias.*

In the analysis carried out on the totality of the productions submitted by the students, and taking into account the different situations proposed in the DCT, in which the properties of the communicative contexts vary, it is surprising that despite the advanced level of the Spanish students, the answers given do not change much regarding use of strategies, linguistic structures or forms of treatment. The formal treatment almost always prevails, regardless of the characteristics of the interlocutor. There are, therefore, certain socio-cultural and socio-linguistic difficulties on the part of students which necessarily affect their level of pragmatic competence.

In a formal context, we presented students with situations in which the social distance between the interlocutors differed, which has direct repercussions on the day-to-day communicative interactions. Two of these situations were to ask a colleague's papers from his or her secretary and ask the boss to leave early. The productions made in German and Spanish were conventionally indirect in both cases and there was no recourse to alternative structures and strategies. By way of example, we can highlight the frequent use of the adverbal modifier *imenso* (*Peço imensa desculpa mas …*) and consultative structures (*Importa-se que eu saia mais cedo?*, *Não te importas de chegar-me esses documentos?*), with which the listener's willingness to do something is underlined and the request is mitigated.

Regarding the Rating Assessment Test, the students were confronted with eight different concrete situations regarding the pragmatic variables of status and social distance, among other aspects. The main objective was to issue a value judgment on a scale of 1 (not appropriate) to 5 (appropriate), and on the justification of the student's choice. Two of the communicative contexts that would be less acceptable in German culture but which would have more acceptance in Spanish were the following, translated here into Portuguese: a) *Vamos pela rua e alguém nos pára e pergunta o seguinte: "Bom dia, a Avenida xyz?"* and b) *Estás sentado num café e dizes ao empregado: "um café"!*

For both languages, the students considered that the requests submitted to the evaluation were done in a discourteous manner, so they indicated adjectives such as *maleducado*, *rude*, *desrespeituoso*, *muito informal* in their justification. At the same time, they commented that a correct request should be made using, first and foremost, more alerters to draw attention and guide the speaker to the speech act (*Olhe* ou *desculpe*). Participants also indicated that it was necessary to use a lexical mitigator like *por favor* or *se faz favor*. The students of the German language were aware that the requests made in the above mentioned contexts are not suitable for the German culture. For the Spanish, they considered that the requests had an imposing and therefore discourteous tone, reason why they classified them as not appropriate. Regarding situations analyzed from the professional context, we observed that the hierarchy plays a fundamental role in the evaluation of what is appropriate or inappropriate. Thus, we noticed that a request made directly using the imperative (quite common in Spanish and less in German), is considered by students a lack of respect in both languages when it comes to an interaction between colleagues (*Mário, passa-me essa pasta!*), while it is more accepted if a higher hierarchical person makes the request (*Marque uma reunião para amanhã!*). Still, in the latter case, students commented that it would be more appropriate to make the request in a more conventionally indirect way, through the use of courtesy markers or a combination of various alerts. As for the treatment, we can observe that in the majority the students give preference to the use of the third person and not of the second one. In general, we observed that students transfer their own cultural patterns, namely social and contextual values, which influences the choice of the strategies they consider appropriate to carry out the request.

Given the way speech acts are performed, they are not universal and vary from language to language, it is evident that in language classes it is important to treat concrete pragmatic aspects, from the intercultural point of view, to avoid interferences that lead to misinterpretations and misconduct during interaction. Thus, it is necessary to familiarize the students, for example, with the most direct way of the Spaniards to use the language. This is also emphasized by Haverkate (1996, p. 51) when he says: "Esta predilección por la expresión directa del mensaje lingüístico se plasma de manera elocuente en el refrán 'Llamar al pan pan y al vino vino". This observation also has its repercussion on the scarce use of the politeness marker *por favor* and on the fact that the requests made more directly are not considered discourteous in Spanish culture (Bernal, 2006).

5. Conclusions

Our interest in the training of speech acts in foreign language classes is due to the fact that an insufficient mastery can lead to critical incidents in intercultural communicative contexts. From our teaching practice, we also learnt that third year students of the degree in Languages and Business Studies still have many difficulties on the pragmatic level. The objective of our study was, therefore, to analyze how the students make a request inside and outside the work context and what they perceived from a concrete act of speech. Given that speech acts are not universal and that there are differences from language to language, it was pertinent to carry out a study for German and Spanish by conducting two surveys that are widely used in pragmatic analyzes: the Discourse Completion Task and the Rating Assessment Test. The results obtained through the analysis of the two tests served to observe to what extent the students' pragmatic awareness is developed and, at the same time, to obtain data on the type of predominant interferences.

We can conclude that the students designed the structures, strategies and perception of the context of their own linguistic-cultural universe for both German and Spanish productions, in a conventionally indirect way. In order to achieve their goal they resorted to only a limited number of strategies that served to alleviate the illocutionary force of the nuclear act. Taking into account that Spanish culture is characterized by positive courtesy, which allows the speaker to reduce the freedom of the listener without the need to use strategies to mitigate the request through, for example, a preparatory question, requests are often made in a more direct way than in Portuguese. In the case of German and Portuguese, where the forms of negative politeness predominate to safeguard the negative social image of the interlocutor, the request is mitigated by the help of several indirect strategies. Finally, we consider it important to carry out studies of this nature, since they provide tools to the teachers that can help them to approach pragmatic contents in the classroom with the intention of developing the students' pragmatic awareness, essential for effective and adequate communication in intercultural contexts.

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From scribe to YouTuber: A proposal to teach the History of the English Language in the digital era

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Abstract

The present paper deals with a proposal for enhancing students' engagement in the course 'History of the English Language' of the Degree in English Studies (Universitat de València). For the purpose, the traditional lectures will be combined with a research project carried out by groups of students (research teams) in which two digital tools will be used: electronic linguistic corpora and YouTube. Electronic linguistic corpora, on the one hand, will allow students to discover the diachronic development of certain linguistic features by looking at real data and making conclusions based on frequencies by themselves. YouTube, on the other, is a most appropriate online environment where students will share a video lecture so that their classmates can benefit from the research work they did, fostering peer-to-peer learning. The expected results are to make students more autonomous in their learning process, as they will be working on their project from the very beginning of the course; and to engage them more effectively since they will be working in a format that resembles what they do at their leisure time.

Keywords: History of the English Language; electronic linguistic corpus; YouTube; peer-to-peer learning; Web 2.0.

1. Introduction

The time devoted in any Spanish degree to the teaching of the History of the English Language (HEL) has been drastically reduced since the adaptation of the high educational degrees to the European Higher Education Area (Bologna Plan). The topics that used to be covered in approximately six courses (both compulsory and elective credits) are now typically condensed into just one. This is an arduous task if we consider the course's chronological scope (usually from the Old English period up to the present-day), its interdisciplinary reach (it deals with phonology, morphology, syntax, external history, etc.; cf. Giancarlo 2017: 59, Hayes and Burkette 2017: 1, or Lanehart 2017: 41, among others), and the time limitations of the semester (barely four months). As a result, it is little wonder that our students perceive the subject as *awesome*, though in the original meaning of the word: 'Inspiring awe; appalling, dreadful, weird' (Oxford English Dictionary, *awesome*, adj., 2; cf. Hayes and Burkette 2017: 1).

In this paper we approach the teaching of HEL from the perspective of digital pedagogy (Tyrkkö 2017: 142) by incorporating new technologies into the classroom. The main aim of this proposal is to make our students come to terms with a course that, at least in principle, is no longer appealing to them. Two are the key digital tools that students will use: electronic linguistic corpora and YouTube. The use of corpora for linguistic research can be traced back to the 1960s, but it is in vogue since the 1990s (cf. Tyrkkö 2017: 141). In our proposal of corpus-based learning, we follow Tyrkkö's (2017: 145) teacher-mediated or research-focused methodologies. Moreover, our students will also use YouTube for presenting their projects.

The paper is organised as follows. Section 2 describes the contents covered in the course together with a timeline; Section 3 focuses on the portfolio task which students should complete by the end of the semester; finally, Section 4 closes the paper with some concluding remarks on the proposal and its implications for the Degree in English Studies at the Universitat de València.

2. The course structure

HEL is taught as a compulsory course in the first semester of the third year of the Degree in English Studies at the Universitat de València. One of our major concerns when planning the course was the organisation of the contents. If the subject is divided into periods, then the diachronic perspective of change over time might be lost as the topics discussed would be approached synchronically at different points in time. In turn, if the subject is divided by content (i.e. by different thematic areas, such as phonology, spelling, nominal morphology, external history, etc.), then we might "leave out the people in favor of paradigms and rules" (Kretzschmar 2018: 2). In other words, the student might lose sight of the reasons why, for

example, a given socio-cultural change (such as the Norman Conquest of England) brought about linguistic consequences (in this case, a contribution to the loss of grammatical case). In the end, the traditional division along the temporal axis has been chosen mainly because that is the organisation proposed by scholars who have deliberated on the same idea (cf. Giancarlo 2017: 61) and the one followed in most grammars (see Freeborn 1992, Baugh and Cable 2002, Cable 2002, Hogg and Denison 2006, Algeo 2010, Millward and Hayes 2012 and Kretzschmar 2018, among many others). However, the portfolio task would still guarantee the diachronic dimension as our students will monitor a given structure across time (cf. Section 3 below). As defended by Tyrkkö (2017: 145), students will undoubtedly benefit from a more traditional teacher-based instruction, but once they have acquired some basic background knowledge, they are ready to become more independent in the process of learning how language changes. To that end, linguistic corpora are a suitable tool as they allow students to make first-hand observations about linguistic usage and change, and "the experience of discovering the past for oneself can be a memorable one, and it almost certainly leaves a more lasting memory for most than simply reading a fact from a book or hearing it in a lecture" (Tyrkkö 2017: 149). Nevertheless, thoughtful planning is required beforehand. Based on the academic planner for 2017/2018 Autumn semester, our proposal is divided into 27 sessions. The contents per session would be organised into five main units, as shown in Table 1 below.

Table 1. Academic planner for HEL

Unit 1. Intro	Project assignment	Unit 2. OE	Unit 3. ME	Unit 4. ModE	Unit 5. PDE & NE	YouTube sessions
Ss 1-3	S 4	Ss 5-12	Ss 13-18	Ss 19-23	Ss 24-25	Ss 26-27

Unit 1: The first unit presents the students with some preliminary notions necessary to understand the development of the English language. These include concepts such as grammaticalisation, lexicalisation, syntactic reanalysis, proto-Indo-European, etc.

Units 2-4: The core of the course is the discussion of the main linguistic and socio-cultural features of the Old, Middle and Modern English periods (OE, ME and ModE, respectively). The three units follow a similar division: first, the external history of the period is presented, and then attention turns to the discussion of the main linguistic features of the time. The six most important linguistic aspects considered are orthography, phonology, morphology of the noun phrase, morphology of the verb phrase, syntax and lexis. The number of sessions gradually decreases from one period to the next as the degree of difficulty also declines. Thus, OE, which is the most opaque and unknown period for students, deserves at least eight sessions. In turn, five sessions are enough for ModE as the language is already transparent

for the students and most of the relevant changes have already taken place. The examples used to illustrate the theoretical explanations include some of the most relevant literary works from each period (*Beowulf* for OE, *The Canterbury Tales* for ME and some plays by Shakespeare for ModE), but also texts from the *Helsinki Corpus of English Texts: Diachronic and Dialectal* (HC) (cf. Section 3.1 below). We will also make our students work with digitised manuscripts such as the *Digital Vercelli Book* so that they get to know how real manuscripts looked like.

Unit 5: This unit is primarily concerned with the English spoken in different parts of the world to make our students aware of the existence of other varieties beyond the two supranational ones (i.e. British and American English). The study of variation in the New Englishes (NE) is increasingly becoming the object of research in recent times (see Mesthrie and Bhatt 2008, and Seoane and Suárez-Gómez 2016, among many others), and it also deserves a place in the Degree in English Studies. In this case, the examples are taken from the ICE corpora, which include texts from a wide range of countries (e.g. Canada, Hong Kong, India, or The Philippines, among others; cf. Section 3.1).

Sessions 4, 26 and 27 have a different dynamic. Session 4 is entirely devoted to the presentation of the portfolio task (for more information on the task, see Section 3 below); and in sessions 26-27 the videos prepared by the students are watched in class.

3. An up-to-date proposal

The present section deals with a teaching proposal in which the use of electronic corpora and Web 2.0 strategies will be incorporated in an attempt to make materials more attractive to students who are described as "Millennials", among other labels (Tapscott 1997; Oblinger 2003; Duffy 2008). They constitute a generation surrounded by digital stimuli since their birth and, as young adults, are in constant interaction with technology and the internet. Thus, students are used to playing video-games online with their friends while they stream on YouTube or Twitch; they follow celebrities and influencers who upload videos on a daily basis; and, instead of a book or even Google, they look for help on YouTube whenever they need it. These leisure activities, among many others, have turned paper-based materials, PDF files as well as PowerPoint/Prezi presentations into something obsolete and static that does nothing but contribute to the students' apathy for a tough and dense subject such as HEL.

3.1. English historical corpora in the classroom

Irrespective of the approach taken by teachers in the teaching of HEL (either dividing the contents by period or by linguistic features), the ultimate objective of the subject is to focus on language change over time. To achieve this, historical corpus linguistics makes use of historical corpora, which are collections of texts especially designed to represent a particular

stage in the history of English so that linguistic change can be assessed (Claridge 2008: 242). The use of historical corpora has enhanced the potential of historical linguistics as: 1) computer-based historical corpora offer the linguist large amounts of data as well as tools for dealing with it (word-counts, frequencies, statistics, etc.); 2) statistical analyses contribute to a better understanding of the way in which linguistic change takes place, either supporting or refuting previous linguistic theories; 3) historical linguistics has adopted more functional approaches, which assess how language structure is affected by language use; and 4) less canonical texts have been made available in corpus format so that genres or text types that had not been paid the attention they deserve can now be used as sources of evidence for linguistic analyses (Curzan 2008: 1091).

It makes sense, therefore, to incorporate corpora to HEL teaching, as scholars in the field have been using electronic corpora for research since the early 1990s.[1] This way, students will not only learn about diachronic processes directly from the source, but also will be trained in historical corpus linguistics by means of real fieldwork. As stated by Curzan, "corpora open the possibility of providing students with an individual, interactive way to investigate larger historical changes, be they syntactic, morphological, semantic, or orthographic" (2000: 81). In order to do this, at the beginning of the course students are divided into small research teams tasked with studying the diachronic development of a particular linguistic feature over time. Depending on the nature of the linguistic feature, these studies will make use of different available corpora so that they can look at different parameters such as sociolinguistic profiles and register/textual variation, among others. This way, students will step into the role of researchers and, consequently, the learning process will be far more engaging and their discoveries and conclusions more significant. The following corpora will be used:

1. HC – *Helsinki Corpus of English Texts: Diachronic and Dialectal* (c. 730–1710).
2. PCEEC – *Parsed Corpus of Early English Correspondence* (1410–1681).
3. ICE – *International Corpus of English* (Present-day varieties of English).

In order to retrieve data from these corpora, students will use *AntConc 3.2.4* (Anthony 2014), a freeware corpus analysis toolkit for linguistic research. The use of these corpora in the classroom will show students how scholars carry out their studies and, more importantly, will allow them to witness the diachronic development of multiple linguistic processes/features by themselves with real sources.

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[1] According to Tyrkkö, "despite the importance of corpus evidence to research, when it comes to teaching the History of English most textbooks do not as a rule provide quantitative corpus evidence and many teachers prefer assigning canonical set texts rather than making corpora available to students directly" (2017: 142).

3.2. Turning students into YouTubers

Simultaneously with the research project, each team will record a video lecture in which they will present their final project with the structure of a research paper (introduction, methodology, analysis and conclusions). For the purpose, each research unit will create a YouTube channel in which they will upload their video. In addition to the required video, students will be allowed to upload a video in which they present the team as well as any other video which they consider relevant for their project. In a nutshell, their YouTube channel will constitute an online space in which they will upload a project in video format and as many supporting materials as they consider necessary. The goal is to offer a thorough explanation of their assigned topic so that their classmates can benefit from the work done.

The application of YouTube videos to the course has a threefold objective: 1) students will be autonomous in their learning process since they will know their team's objective from the very beginning and, thus, lectures and secondary readings will be more appealing to them; 2) once they finish their videos, all students will be able to watch them, and the diachronic development of everything contained in the course will be available online for students; and 3) peer-to-peer learning will take place inasmuch as students will be able to learn about diachronic phenomena explained by their classmates.

The methodological part is of paramount importance in this teaching strategy as the two teachers in charge of the subject will have to deal with approximately 12 groups of 5 students (60 students altogether). This means c. 12 research projects displayed in 12 YouTube channels. The following subsequent stages will be completed by students:

1. Project assignment. In the fourth session of the course, each group will be assigned a topic and a corpus to be used as the input. After that, the teachers will explain the theoretical background for each period in the following sessions, and the students should, with that theoretical frame in mind (but also with additional secondary material uploaded to Aula Virtual), trace the diachronic development of a given linguistic feature (e.g. the grammaticalisation of *while* from noun to conjunction; cf. Brems and Hoffmann 2017: 139) across time.
2. Meetings with the teachers will be arranged after units 2, 3, and 4 so that the students can report on their ongoing project. Thus, the teachers will monitor the process and correct methodological/content mistakes.
3. Along similar lines, each research group will be assigned a teaching assistant (TA) once the project is written by the research teams and proofread by the two teachers in charge. TAs will help improve our students' expression and pronunciation.
4. Research teams have roughly two weeks to record their videos and upload them to their YouTube channel. The format in which they present their project is optional. Different examples will be made available so that research teams can choose.

5. The videos are displayed in class and students can ask questions to the different research teams. At the end of each video, each group should test whether or not their classmates have understood the explanations by means of a quiz, which may take the format of online review games, such as Kahoot or Quizizz. By doing so, students would benefit from the experience of becoming teachers for a day.

4. Conclusions and implications of our proposal for the Degree in English Studies

In the sections that precede, a new approach to the teaching of HEL has been proposed trying to pave the way for a change in the perception of the subject on the part of students. The digital methodology here suggested not only involves the use of electronic linguistic corpora (the *sine qua non* of Historical Linguistics; cf. Tyrkkö 2017: 142), but also the integration of social media (the *sine qua non* of college students) in the classroom. As a result, many different general and cross-curricular learning competencies of our degree are enhanced thanks to the portfolio task, but special mention must be made of the following: application of ICTs (CG03), team work (CG04), critical thinking and interpretation of data (CB3), transmission of knowledge (CB4) and autonomous learning (CT01). Our students would also benefit from the contact with native speakers during the rehearsal of their videos, something which would no doubt help them improve their pronunciation and their communication skills. Finally, we should not forget that peer learning can help students learn effectively, and giving them the chance to take on the role of the teacher may be highly beneficial for those who will eventually become teachers in the future, which, in a degree like ours, is a very high percentage.

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Pluricultural competence and VIQTORIA didactic model action in Spanish as a Foreign Language learning systems

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Abstract

This paper is about a didactic action model named VIQTORIA that intervenes in the process of pluricultural competence acquisition. This work aims to characterize how the postulates of the VIQTORIA model are fulfilled on printed and digital learning systems commonly used in Spanish as a Foreign Language teaching. In order to achieve that, five criteria support the creation of a corpus that classifies 10 learning systems into two categories. The systems are characterized using a diagnostic tool composed of 338 items grouped in 60 parameters, which are distributed in 9 blocks. These blocks capture the four postulates of VIQTORIA: the qualification of the competition, the structuring of the thematic core, the didactic iteration and the operativization of the skills acquisitions device, as well as the constructs that operationalize the pluricultural competence: the Sociocultural Proximity and the Linguistic Posture. The quantitave nature of the diagnostic tool favors the triangulation of results. However, this work is part of a broader heuristic investigation in which the emergence of theory is predominant. Even though the results suggest a considerable room for improvement, the systems analysed, by their digital nature, are involved in constant evolution which could lead to them overcoming the limitations of the traditional teaching-learning paradigm.

Keywords: Pluricultural competence; Sociocultural; Linguistics; Learning models; Educational models.

1. Introduction

The CEFR establishes the acquisition of pluricultural competence as a goal for European citizens (Council of Europe, 2001). Integration with the target culture is a challenge for Spanish as a Foreign Language (hereinafter, SFL) learners in an immersion context. Holgueras (2017a) suggests the need to improve their pluricultural competence through a pedagogical innovation. This has guided the design of a didactic action model, called VIQTORIA, which emphasizes aspects traditionally neglected in the teaching-learning processes with the intention of generating competition-acquisition processes: the purpose is the acquisition, the way is the competition.

This work is derived from a heuristic research project, where emerging theory relates to two main constructs, Socio-Cultural Proximity (hereinafter, SCP) and Linguistic Posture (hereinafter, LP), which operationalize the pluricultural competence. The research question is centred on how the VIQTORIA model postulates are fulfilled in the most commonly used SFL learning systems in order to develop SCP and LP. For that purpose, a diagnostic tool has been created to estimate the compliance of the analysed learning systems with the model underlying principles, synthesized in four postulates: the qualification of the competition, the structuring of the thematic core, the didactic iteration and the operativization of the Competences Acquisition (hereinafter, CA) devices.

1.1. Description of the VIQTORIA didactic action model and his four postulates

These postulates are more broadly described in Holgueras (2017b), but it seems convenient to summarize them briefly. The first postulate is the result of a process where, in the first place, the concept of competition is reviewed from different approaches (Fulu, 2007; Jiménez, 2012); secondly, the mistakes made in its conceptualization by Deutsch (1949) and Thiess *et al.* (2004) are identified; thirdly, *competition* is distinguished from *qualified competition* in order to solve the "category-mistake" (Ryle, 1949, p. 16), following Shindler (2009), who opposes *competition* to *healthy competition*, and Cantador (2016), who distinguishes *competition* from *cooperative competition*; fourthly, the legitimization conditions of the competition in the competences acquisition process are established: the competition is qualified when it is ludic, unprepared, authentic, social-cooperative, communicative, meaningful and ethical; and, lastly, the balance mechanisms that guarantee the qualification are established. The second postulate inquires about the thematic selection and integration of contents (Kramsch, 1993; Kumaravadivelu, 2003; López, 2008) through the structuring of the ludic and curricular axes (Fernández, 1997). The third postulate analyzes the possibilities and the sense of incorporating the iterative cycles to the learning process. The fourth postulate identifies the distinctive features between Teaching Object and CA device through the operations that ensure their integrated modularity. The third an

fourth postulates are conceived to solve the text book weaknesses detected by Santamaría (2008) and Ezeiza (2009).

2. Methodology

The parameterization of the VIQTORIA postulates and the SCP and LP constructs in the diagnostic tool give this work a quantitative outlook. However, it is part of a larger, mainly qualitative project, where the characterization of these postulates in the systems prevail, and emerging categories are grouped.

2.1. Composition of the corpus: the five criteria involved and the systems selected

The corpus is composed by a selection of systems used in the teaching-learning processes of SFL for the development of the pluricultural competence in an immersion context. Due to the heterogeneity of the offer and the absence of conclusive and recent literature that define the kind of products, and how many and which are the paradigmatic ones, it is essential to establish five criteria for their analysis and categorization: pedagogic sufficiency, specificity, ubiquity, innovation and autonomy of use.

The pedagogic sufficiency establishes the distinction between system and resource. A system possesses pedagogic sufficiency when it includes all the essential components of a syllabus explicitly or implicitly (objectives, contents, methodology and evaluation). A resource, however, possesses an accessorial character and lacks one or more essential components of the systems designed to conduct the teaching-learning process. Following the resource classification in Arrarte (2011), the resources for the communication and virtual communities (e-mail, Internet forums, blogs, podcasts, social media, etc.) are not considered systems, neither the didactic resources in SFL of the Cervantes Virtual Center (Centro Virtual Cervantes) nor other resources of general nature, such as dictionaries or search engines. In the same way, diverse existing tools for the incorporation of gamification elements, such as Kahoot or Classbadges, do not enjoy pedagogic sufficiency either.

The systems are categorized through an axis of cartesian coordinates divided into four quadrants. On the horizontal axis, the systems are classified according to the autonomy of use, that is, if by design it places the student in an independent or collective activity, guided by a teacher. On the vertical axis, they are arranged according to their level of innovation. The systems are classified as conservative, when there is a transfer of the traditional teaching-learning processes to the digital environment, or as transformative when predominate interactions and processes originally created for a digital environment hardly reproducible outside of it.

In this way, the most conservative and less autonomous systems are called Editorial Products (hereinafter, EP); and the most transformative and autonomous, Applications

(hereinafter, APP). Regarding the frequency of use or ubiquity, the EP are selected according to the data sent by the editorials about the systems with greater distribution: Aula internacional (Difusión); Español en marcha (SGEL); Generación 3.0 (enClave ELE); Nuevo prisma (Edinumen); Vente (EDELSA). The APP are selected according to the number of downloads shown on the *Google Playstore*: Duolingo (more than 50 million downloads); Babbel (more than 10 million); Busuu (more than 10 million); Memrise (more than 10 million); Rosetta stone (more than 5 million).

The fact that the sample was restricted to these categories (EP and APP) doesn't deny the existence of other types of systems that meet the criterion of pedagogic sufficiency: Learning Management System, Gamified Learning Systems o Massive Online Open Course. Although they allow the construction of complete syllabuses of any discipline, this versatility implies a lack of contents, activities, and so on. They have the capacity to contain a hypothetical product, but they are not valid to evaluate any concrete content as a part that belongs to the system from scratch. Thus, this restriction is justified by the criterion of specificity, which defines the set of systems created especially for SFL.

2.2. The data collection tool: the improvement of the template

The template is used to analyzed the fulfillment of the postulates of the didactic action model in the print and digital systems that compose the corpus. In this work, we applied the 1.1 version of the template, codified in Excel, that resulted from the validation and piloting process of the 1.0 version, developed in QuestionPro. The main findings that motivated this change stand out the substitution of a sequential codification (each system independently) by a simultaneous codification (which favors the comparison between systems); the integration of the data codification and interpretation that avoid a later data treatment; the greater ease of movement between sections and the modification of the entered values; and the simplification of the original design by the removal of conditional itineraries, which facilitates future iterative processes of refining the template. Another significant change is the substitution of a dichotomous scale (with two possible states: compliance or non-compliance, $v = \{0, 1\}$) by a scale of three values ($v = \{0, 1, 2\}$, where 0 means the non-compliance or absence of the parameter; 1 means the insufficient compliance with what is prescribed by the VIQTORIA model; and 2 means the compliance according to what is postulated in the VIQTORIA model).

Regarding its structure, version 1.1 operates as a spreadsheet in Excel. The constructs SCP and LP are encoded on different sheets. Each postulate has its own sheet, except the qualified competition, which is divided into four sheets: three for the events that are inherent in it plus a fourth one with the balance mechanisms. Another sheet is devoted to the universal features that affect all postulates globally.

3. Analysis of results: VIQTORIA model, SCP and LP in SFL learning systems

The results of the application of the template to the corpus are presented according to the postulates of the model. As shown in table 1 and table 2, in global terms, the EP and the APP systems obtain a low average (0,41 and 0,31, respectively).

Table 1. Compliance with the postulates of the VIQTORIA model and the SCP and LP constructs in the systems grouped as APP category.

Postulates	Learning Systems Average	Media EP	APP1 Duolingo	APP2 Babbel	APP3 Bussuu	APP4 Memrise	APP5 Rosetta Stone
Qualified Competition	0,35	0,24	0,33	0,20	0,25	0,33	0,19
Thematic Core	0,45	0,44	0,48	0,33	0,42	0,53	0,44
Didactic Iteration	0,19	0,29	0,53	0,00	0,00	0,53	0,39
DAC Operationa-lization	0,32	0,29	0,34	0,22	0,28	0,38	0,25
Global	0,49	0,45	0,52	0,36	0,46	0,51	0,41
VIQTORIA	0,36	0,34	0,44	0,22	0,28	0,45	0,34
SCP	0,11	0,08	0,00	0,00	0,00	0,40	0,00
PL	0,63	0,60	0,67	0,50	0,67	0,67	0,50
Constructs	0,37	0,34	0,33	0,25	0,33	0,53	0,25
Average	0,36	0,31	0,38	0,22	0,28	0,43	0,27

Source: Own elaboration.

The mean of all the systems shows that only the Linguistic Posture (0,63) exceeds 0,5 points. This is consistent with the attention traditionally given to the linguistic over the sociocultural. The most abundant constructs among the APP are the ones already mentioned LP (0,60), the universal parameters (0,45) and the structuring of the thematic core (0,44).

Notable among the EP (table 2) are the LP (0,67), the global parameters (0,53), the qualified competition (0,45) and the structuring of the thematic core (0,45). On the other hand, the equilibrium mechanisms (0 on both categories), the SCP (0,08 in the APP, 0,14 in

the EP) and the iteration (0,29 and 0,1 for an overall average value of 0,19) were left behind.

Table 2. Compliance with the postulates of the VIQTORIA model in the systems grouped as EP category.

Postulates	Learning Systems Average	Media EP	EP1 Aula Interna-cional	EP2 Español en marcha	EP3 Genera-ción 3.0	EP4 Nuevo Prisma	EP5 Vente
Qualified Competition	0,35	0,45	0,48	0,47	0,52	0,37	0,44
Thematic Core	0,45	0,45	0,45	0,44	0,50	0,43	0,43
Didactic Iteration	0,19	0,10	0,00	0,00	0,50	0,00	0,00
DAC Operationalization	0,32	0,35	0,37	0,34	0,44	0,28	0,34
Global	0,49	0,53	0,55	0,55	0,68	0,40	0,50
VIQTORIA	0,36	0,38	0,37	0,36	0,53	0,30	0,34
SCP	0,11	0,14	0,30	0,00	0,00	0,40	0,00
PL	0,63	0,67	0,67	0,67	0,67	0,67	0,67
Constructs	0,37	0,40	0,48	0,33	0,33	0,53	0,33
Average	0,36	0,41	0,43	0,39	0,49	0,37	0,38

Source: Own elaboration.

In Figure 1, the most prominent APP are Memrise (0.43 - APP4) and Duolingo (0.38 - APP1), which are the most gamified ones. Among the EP, stand Aula Internacional out (0, 43 – PE1) and, especially, Generación 3.0 (0,48 – PE3). Generación 3.0 is as well the EP that has the most advanced gamification.
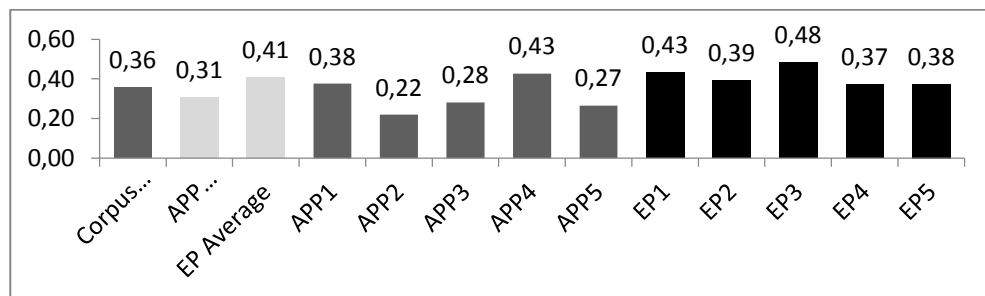
Figure 1. Performance of the complete corpus, of the APP and EP categories and of each system in compliance with the VIQTORIA model and the SCP and LP constructs. Source: Own elaboration.

Figure 2 offers an eloquent graphic representation about the scores obtained by the parameters according to the categories APP and EP, thus facilitating the perception of contrasts. The iteration is the only postulate in which the APP obtain a better score than the EP (0,19 difference). The structuring of the thematic core is the postulate in so much as there is a smaller distance in favor of the EP (0,44 and 0,45) and the qualified competition is the one with a greater difference (0,21 separate APP and EP). However, in the overall calculation of the VIQTORIA model, the difference between APP (0.34) and EP (0.38) is only 0.04.

	Qualified Competition	Thematic Core	Didactic Iteration	CAD Operationalization	Global parameters	VIQTORIA	SCP	LP	Constructs	Average
APP	0,24	0,44	0,29	0,29	0,45	0,34	0,08	0,60	0,34	0,31
EP	0,45	0,45	0,10	0,35	0,53	0,38	0,14	0,67	0,40	0,41
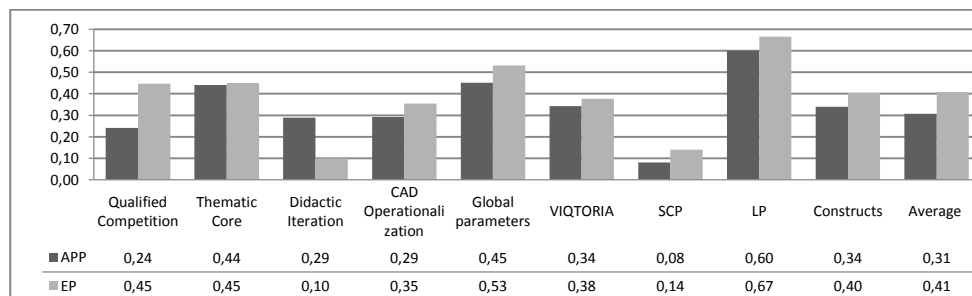
Figure 2. Performance of the APP and EP categories in compliance with the VIQTORIA model and the SCP and LP constructs. Source: Own elaboration.

4. Conclusions

The VIQTORIA model tries to put forward an enriched vision that abandons the traditional teaching-learning coordinates and advocates opening the frame of understanding to establish as a reference the competition-acquisition pair, that refers to how (by competing) and why (to acquire competencies). The results show that the systems analyzed do not comply with this approach.

In summary, the results manifest a considerable improvement margin. Even more if we consider that the score range is not from 0 to 1, but from 0 to 2. In this sense, the nature of the digital systems supposes a mitigator. The provisional nature of the results is recognized as it is a set of dynamic products, in permanent development process, and this capability of improvement, which in a sense means a limitation for the research, paradoxically manifests one of the most attractive characteristics of these new resources: its greatest potential lies in the possibility of creating original digital modes, going beyond their adaptation to a digital environment.

To close, we propose a final reflection that highlights the insoluble relationship of the VIQTORIA model and the competition-acquisition process, derived from a shared genesis in this research. The acquisition of competences is a complex, dynamic and multimodal process that includes, but also exceeds, certain pedagogic visions. Rethinking the acquisition of competencies as a qualified competitive act allows us the integration of a series of characteristics (ethical, ludic, social-cooperative, communicative, unthinkable and authentic) as a condition of its legitimation.

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The Joint Effort Workshop as a tool for Knowledge Management and competence development

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Abstract

Cybersecurity is a complex global phenomenon where the risks for individuals, organisation and the society are rising day by day. These risks need to be identified and analysed in order to spread prevention and elaborate countermeasures. In this paper, we describe the Joint Effort Workshop 2019 as an approach to raise awareness to these threats and to generate and share knowledge about Cybersecurity and Critical Infrastructure between students and field experts.

We believe that mechanisms for systematic response to attacks need not only the developed technical requirements, but also a deep understanding of the human behaviour, knowledge and resilience to response to risks. This approach towards knowledge and practical training can be experienced through the collaborative environment of the Joint Effort Workshop.

***Keywords:** Virtual Collaboration; Knowledge Management; Organizational Learning; Cybersecurity; Critical Infrastructure; Collaborative Learning.*

1. Introduction

A globalised and internationally connected world entails consequences on individual and organisational level, where especially in the field of Critical Infrastructures and Cybersecurity the risk and impact is most visible. Since events like the Cyberattack on Estonia in 2007, the ongoing massive attacks through Fake News on multiple levels of any democracy, hacking sensible data and passwords or the chain reaction of interconnected supply facilities in the water, energy or communication sector, the public attention towards these topics has increased. The demands of digital technologies and steadily interconnection is redefining the way how to deal with collaboration and communication. Here, interdisciplinary and systematic while simultaneously flexible approaches in education and application are needed. Higher education institutions like the OTH Regensburg are facilitators and enablers of creating ways to prepare and educate young professionals for the upcoming challenges. Research as well as experienced experts propose effort on hands-on learning and experiencing to prepare young professionals for challenges and crisis management through education (Senge, 1990, Carell, 2004, BBK, 2011, UN OCHA, 2018). Furthermore, there are different ways to tackle these challenges and to implement digital literacy, raise awareness on current fields of concern and to develop a set of skills are investigated and outlined (EC, 2011, HFD, 2016, NMC, 2017, Kolb, 1984). One practical approach, where students, managers and experts can exchange and interact to generate knowledge and develop competences is the later presented Joint Effort Workshop concept.

The paper presents how to face the challenges of the technological and digital change with a hands-on approach in higher education in collaboration with experts and organisations through the Joint Effort Workshop. We first briefly examine the work environment. Later we outline the concept of Organisational Learning (OL) and Knowledge Management (KM), before we introduce the concept of the Joint Effort Workshop, as a tool for competence development, Knowledge Management and as an innovative environment. The paper concludes by describing the advantages of the learning concept for organisations and individuals likewise.

2. Work Environment and Characteristics

As technology and digitalisation is shifting the workplace towards a virtual environment, using Information and Communication Technology (ICT) and digital tools and loosen structures like hierarchy, organisations and centralisation, it can have positive consequences like increased productivity, saving resources and opening global opportunities. Anyhow, negative impact and even threats are arising within this change of interconnectivity and behaviour in the virtual environment. The high risk of all interconnected infrastructure consists of being vulnerable to cyberattacks. Thus, globalisation and virtual organisation need

adapted global structures and processes, as humans as users are in need of a comprehensive awareness, understanding and set of skills to be able to meet these demands.

2.1. Virtual Collaboration

Since the implementation of technological developments and digital advances in nearly all sectors, the virtual collaboration and communication is omnipresent. It means an independent and dedicated working process of a group of individuals who pursue a common goal, collaborating and communicating to overcome spatial, temporal and organisational obstacles by electronic means (Lipnak & Stamps, 1998, Wainfan & Davis, 2004). This entails new structures like asynchronous group work in a virtual space and shifted leadership and management focus. In addition, this leads to face ways of shared responsibilities, cultural and language challenges, and implicated risks in knowledge management and also cybersecurity.

Data and information are always and everywhere accessible and retrievable which has impact on the flexibility of the work environment and processes and the vulnerability of the system itself. Through the close connection of technological means, cooperation, collaboration and knowledge exchange are getting easier, as we can see with the Internet of Things (IoT) or Smart City approaches. The positive opportunities of technological developments are accompanied by rising computer-related crimes, exploiting system vulnerabilities aiming at illegal activities to make profit or causing harm. Cybersecurity is one part of the Critical Infrastructures of a nation or an organisation, which is subject to multiple threats. Therefore, collaborative effort to develop strategies and concepts have to be started to manage activities like raising awareness of the threats itself and to start defending public and individual safety against vulnerabilities or attacks (Solms & Niekerk, 2013). To keep up with this complexity of threats and to learn from experience, we must focus on the early phases and the scenario preparation before attacks occur, to create a basis and common ground for detection, prevention and crisis management. Collaboration and information sharing about vulnerabilities, threats and processes can improve the overall security, but the actual implementation of a common approach is interfering with an organisational or individual agenda. The complete process takes time, resources and trust. To overcome these difficulties standards and processes should be developed. In the following part we explain Organisational Learning (OL) and the Knowledge Management (KM) as a possibility to serve as the first step towards an actionable approach.

2.2. Organisational Learning and Knowledge Management

Every organisation and company is using collaboration networks or tools, like Slack, Trello, Adobe Connect, Sharepoint or cloud solutions, to provide a digital workspace to communicate, store and exchange information, share ideas and manage projects. The knowledge is the heart and soul of every organisation, even more since it is often recognised

as the 4th production factor (alongside land, labour and capital). Therefore, organisations face knowledge and information at large, as the crucial factor for their ventures. Knowledge has to be organised and planned to serve for individual and organisational success. At latest since Argyris and Schön (1978) introduced the concept of "Organisational Learning", and Senge (1990) the "Learning Organisation", a common understanding of the need of an adapted behaviour towards a successful future is ongoing.

Learning is known as the dynamic development of individuals while detecting and correcting errors, and one could argue that the commutation of the individual knowledge is the first step of organisational learning, where the generated knowledge can be stored and exchanged. (Schein, 1992). While OL is focusing on the processes, KM attempts to acquire, create, process and utilise the generated knowledge (Easterby-Smith & Lyles, 2003). The goal is to continuously improve practices and behaviours in learning cycles.

The technological developments and change lead to an adaption of education approaches to embed the real-life education to experience and problem-based learning collaborating on platforms and innovative environments interlinking with experts and in-field organisations. These approaches will have a positive impact on lifelong learning, skills development and networking to tackle current and future challenges through the participatory hands-on experience of the participants in an activating and empowering real-life setting where knowledge is applied and skills developed.

To be able to generate knowledge, it would be necessary to implement collaborative efforts with learning and experiencing. The OL can serve as a tool to improve effectiveness, enable change of perspective and understand the complexity of challenges as well as provide the environment of information and knowledge exchange to preparation of risks. One possibility to provide such an environment is through the presented Joint Effort Workshop.

3. The Joint Effort Workshop

The Joint Effort Workshop 2019 is part of a project series on multinational, trans-organizational and intercultural collaboration. The purpose is to tackle current issues and develop solutions through virtual cooperation allowing scholars from all over Europe to take part. A combination of input from subject matter experts and research conducted by the participating students support this task.

The workshop in 2019 addressed the topic of Critical Infrastructures and Cybersecurity. While the protection of Critical Infrastructures and their risk of cyberattacks has been of current discussion throughout the years, knowledge on this up-to-date topic is still very low among scholars. Thus, the workshop aims at creating awareness for students by providing

expertise on Critical Infrastructures and Cybersecurity including definitions, national and European legislation, incidents and European cooperation.

Throughout the workshop, students will conduct research, present their results, and actively participate in discussions with experts of an international context through virtual collaboration. The workshop supports the participants' problem solving, team working and communication skills.

3.1 History and Concept

The .dot platform serves as a mean for transferring knowledge and further education, and advanced training in the field of virtual collaboration. For this purpose, the .dot platform is the basis for most diverse qualities of sustainable acquisition and transfer of knowledge deriving from multinational and multicultural collaboration. Since 2012, different project groups of students of the study program "International Relations and Management" at the OTH Regensburg under supervision of Prof. Dr. Markus Bresinsky fill the platform with their distinct projects, namely the Joint Effort Series, the GLOBE Exercise and various Summer Schools.

The focus of this paper is the Joint Effort Workshop where the following projects have been implemented over the last years:

- "Shared Situational Awareness Workshop" (2013/14)
- "Joint Effort Ivakale" - training and collaboration in a fictive scenario on development cooperation with real partners in Ivakale/Kenia (2014/15)
- "Joint Effort Virtual Multinational Exercise" - Improving the long-term prospects for potential migrants from Africa in their home countries through development cooperation (2015/16)
- "Joint Effort big.dota Workshop" - Bringing together Data Analysts and Social Scientists (2016/17) and the
- "Joint Effort Workshop 2019" - Virtual Collaboration on Cybersecurity (8.-9. February 2019)

During the Joint Effort Workshop 2019, students are going to work at their home university and virtually with students from universities across Europe on the challenges and opportunities of Cybersecurity while training virtual competencies. Special focus will be put on the protection of Critical Infrastructure.

The two-day workshop will start with a general expert input on Cybersecurity and Critical Infrastructures. Following that, students will conduct research themselves on the status quo in their home countries (U[1]), answering questions such as: What regulations and strategies concerning Cybersecurity and Critical Infrastructure already exist in your country?

Once participants have an understanding of the situation in their respective country, they will tackle the issue from a more practical approach. They will gather information about a cyberattack that happened in their home country and with their newly acquired insights, they will brief students from the other European universities and exchange information in a virtual conference. The day will end with a expert session on how to organize the knowledge gained on the first day.

On the second day, students will have the chance to hear about hacking. In the next step, they will discuss possible challenges and opportunities for international cooperation. Experienced professionals will support the discussion by joining in international virtual groups (U^1, U^2, U^3). Additionally, input is provided by an expert on international cooperation on Cybersecurity and Critical Infrastructures.

Course of the Joint Effort 2019 Workshop

Day 1	Day 2
Expert Input 1: Introduction to the topic	Expert Input III: Hacking
On-site research on legislation in home country	Virtual discussion on international cooperation
Research on cyberattacks in home country	Expert Input IV: International Cooperation on and challenges of Critical Infrastructures and Cybersecurity
Expert Input II: Modelization of knowledge outcome	Feedback

Figure 1 Course of the Joint Effort Workshop 2019. Source: Own figure (2019).

The Workshop concludes with a joint feedback session, where all participants come together to discuss the generated results and give their view about the content and proecedure of the workshop.

3.2 Learning Objectives and Intended Outcomes

Recognising the importance of sharing information about crises, incidents and information and to raise awareness of the context itself, the workshop aims to create an environment where cross-sectional participants can exchange information and ideas and to get introduced to this important topic of Cybersecurity and Critical Infrastructures.

Placing the workshop setting into academic context, a safe and secure environment to train, experience and create ideas with simultaneously connecting students and experts for future development and innovation in the field is possible. The main focus is to actively engage

participants, create a network and enable learning and ideation with knowledge creation and exchange. For an overview, the main objectives are visualized in the following figure:

Joint Effort Workshop

Skills
- Experience opportunities and challenges of virtual collaboration
- Get acquainted with virtual team management and group dynamics
- Learn to work in virtual conference rooms
- Work in intercultural and interdisciplinary teams
- Train English language skills

Expertise
- Gain first insights into the topic of Critical Infrastructures and Cybersecurity on national and international level
- Receive first-hand knowledge from high-profile experts
- Elaborate praxis-relevant questions and develop innovation solutions

Figure 2 Learning Objectives Joint Effort Workshop 2019. Source: Own figure (2019).

4. Conclusion

In this paper, we have described the possibilities of the Joint Effort Workshop to enhance learning and development aside of raising awareness in the field of Cybersecurity and Critical Infrastructures. The collaborative environment, connecting students and experts through interaction, discussion and feedback sessions, provides the advantage to create and later exchange knowledge which can be used in real-life. Where students learn new knowledge and ideate or innovate in the topics, experts and society benefit from the innovative character.

Through experience and feedback from previous workshops, we have determined that although collaboration and knowledge exchange between students and experts would be beneficial to everyone involved, several barriers to efficient collaboration exist, such as obstacles in the virtual collaboration and communication, information and data management exchange with privacy. Whereas, the overall feedback is positive and experts highlight the innovation and creation of new ideas. Moreover, students are keen to experience real-life involvement in a virtual environment on a challenging important topic. We argue that there is a need to interweave the threats of complex security challenges and human behaviour in order to develop awareness and solutions for current and future risks, especially in the rising fields of Critical Infrastructures and Cybersecurity. The workshop enables participants to test and improve both their theoretical and practical knowledge sharing impressions, processes and methodologies. This last aspect, in particular, facilitates the mutual sharing of different levels of knowledge and expertise in order to find new approaches and possible solutions to the problems analysed. In addition, there is the chance to develop durable networks that will help students and field experts to connect and share innovative ideas. These last aspects totally fit with our vision of Joint Effort. Our workshop aims to develop awareness on the concept of resilience, Cybersecurity and Critical Infrastructure in an innovative environment where students and experts debate and develop new ideas.

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Teaching Operations research, the experience of the Catholic University in Bolivia

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Abstract

The Catholic University of Bolivia undertook an experience to develop profesional competencies in students of Operations research and to position the tools of this specialty to help improve the management of private companies.

The paper presents the implementation of a new methodology (Project Based Learning) for teaching the subject of Operations Research to a group of students from different fields at a national context during a period of 5 years.

Students must perform a project on small companies in order to gain the competences related to the course of Operational Research. The paper analyzes the change of methods (from traditional ones based on the passive role of students to a participative model where student applies their knowledge to their daily activity) teaching mathematics in Bolivia. The company representatives play an active role monitoring and assessing the implementation process.

The evaluation of the students shows that the competency has been developed to the expected level and Operations research has now a place in the management of small companies.

Keywords: Teaching experience; Operations research; Project approach; Authentic evaluation.

1. Introduction

This document presents the experience from the Catholic Univesity of Bolivia in the last 5 years around teaching Operations Research to a group of students from different fields. This experience was developed in a national context that is very limited in industrial and company management aspects. Therefore, the strategies of this process focused on the improvement of the management of small companies. The course's aim is to increase the students' interest to attain a profesional competency to the planned level, and to extricate the procedural approach from mathematics teaching, in order to deepen the analysis and proposal.

The approach is Project Based Learning. The evaluation is authentic and the project implemented by the students in small companies is the tool to gather information necessary to verify the development of the competency. The companies' representatives become partners for the monitoring of the projects and for the evaluation of the competencies development.

The results that have been achieved during this period are encouraging in regards to a new way of teaching mathematics. Students show great interest about Operations research – many tesis and dissertations use it as a main tool – in contrast to what happened before; the competency has been developed mostly by the students, they are more analytical and the proposals they present are coherent, judicious and feasible; additionally, more companies are being made aware of Operations research.

The main conclusion from this experience is that it is posible to tackle mathematics teaching in a different way, targetting significant learning and the need of every student to take responsibility for its education.

2. Context

Micro and small enterprises create jobs for a big amount of people, and their contribution to Bolivia's GDP is important, as they represent over 90% of the economic units in the country (Sistema integrado de información productiva, 2016), for this reason, the state has decide to strengthen their productive and managerial capacities (Viceministerio de micro y pequeñas empresas, 2019). The state recognises that the people who created these companies need training, and it has stablished appropriate mechanisms for this (Law 943 of micro and small enterprises, 2017, Art. 22nd). Along this line, the course on Operations Research in the Catholic University of Boliva is intended to contribute to this strengthening.

On the other hand, mathematics teaching in Bolivia follows the traditional line of emphasizing the procedural aspect. Classes on Calculus, in this University, teach students

to derive functions, to calculate the limits and to integrate them. The tests, the same for all students, focus on the manual resolution of problems; students cannot use laptops, calculators, mobile phones (cellphones), or any support textbook, showing the importance of memorization of different topics instead of analysis.

Since the class of Operations Research sits at the Mathematics Department, the approach has traditionally been the same.

Nevertheless, the Competencies approach is, gradually, consolidating within the higher education system in Bolivia (Comité Ejecutivo de la Universidad Boliviana (CEUB), 2016, pp 77-80), and this has opened new opportunities for teaching mathematics, although there is strong resistance from the professors, particularly the older ones.

The Catholic University of Bolivia has started a process, since the beginning of the 21st century, a change in their academic model, by focusing on the development of competencies. It started a sustained training process for professors, and many departments and careers have started its implementation. The Department of Basic Science – to which Operations research belongs is undergoing a slow transition, particularly in the Mathematics area.

Operations research is a discipline that consists of the application of advanced analytical methods to support decision-making processes, identifying the best possible courses of action. Operations research works with mathematic models, statistical analysis and mathematic optimization, to reach optimal solutions, or the closest alternative, to complex decision problems. The expectation is that the decisions made using operations research are better in comparison to those taken by following intuition or the experience of the person making those decisions (Mahto D, 2012). Its teaching, following a traditional approach, is reduced to theory and decontextualized examples, causing little interest in students and the unawareness of its virtues by companies.

In the Catholic University of Bolivia, this is a mandatory course for many fields, bringing together a heterogenous group of 50 students. These students are usually between the fourth and eighth semester of their careers, creating an environment that appears to be very complex to manage. On some occasions, students of other fields also choose to take this course voluntarily, making the group even more diverse

The students are 20 – 22 years old, most of them male. They participate in one or many social networks and are, constantly, looking at their phones. They are very good at finding information online, but not as good when it comes to selecting valid information. Additionally, according to their explanation, they keep the information they find, but rarely read it.

Few of them show their familiarity with the topic or how it could help their knowledge. At the moment of the diagnostic assessment their procedural capacity is evident, but it is also clear that they have conceptual and analytic weaknesses. They almost never anticipate the result of applying a procedure, and they are not used to confronting their results with a prior assumption, the result of the analysis of the situation.

During the last twenty years before this experience, there have been few dissertations using Operations research as a central element in this University.

3. Method

Due to the topic and the context, this course has three objectives: to propose an interesting study subject to the students, one that is also motivating and that will allow the discovery of the real potential of Operations Research; to develop a professional competence in the students and to position Operations Research as a tool that companies can use for their benefit.

The idea was to bring together the interests of students with the needs of the companies, using Operations Research as an intermediary. In this way, students would be involved in the development of the course, its implementation and the evaluation, to make them feel responsible and to make them see the need to get involved in national issues to contribute with technical solutions.

Students must develop a proposal to improve the performance of a small business. In order to do this, they must apply the techniques of operations research, make mathematical models, experiment with them, analyze the results, analyze the sensitivity of the answers and elaborate a coherent, feasible and sensible proposal to improve the performance of the company.

To help with the execution of the mathematical models of these tasks, during the semester, students face several related problems, but disconnected from the companies, the approach for these tasks is Problem Based Learning (PBL). The problems must guide and motivate them to work on their projects. A successful experience is to present them with a national issue (for example, prioritization of public investment projects in municipalities with a reduced budget), another problem of personal importance (for example, personal diet or a problem linked to their career) and others of general interest (for example allocation of scarce resources, location of deposits).

The evaluation of the development of the competency is authentic. The execution of the project is the means to decide whether the student has developed the competency to the desired level.

During the PBL phases, they look for information and receive orientation from the professor; during the programmed class session, students work on the tools they will use at the computer lab, the specialized software and other operational details.

Table 1. Methodology

	Methodology	Time	Activities
1st part	PBL Personal:	2 weeks	Search for information, model construction, model resolution, result analysis, preparation of an optimisation proposal, reflection and preparation of a theory.
	PBL National:	2 weeks	
	PBL General:	2 weeks	
2nd part	Project based learning	8 weeks	Getting to know the company, interviews with key people, document reading, identifying opportunities for improvement, preparing mathematical models, solving models, results analysis, analyzing the sensitivity of the answers, preparing optimization proposals, presenting these proposals

Source: Elaborated by the author

During the time of the intervention in the company, students have a self-regulation tool previously agreed on. This tool is used as a guide for weekly reports and is the self-assessment rubrique they apply to their research.

The authentic evaluation helps assess both the implementation process and the result (the proposal):

- There are three information sources for the final score over 100 points: students themselves (20), the entrepreneurs (30) and the professor (50).
- The rubric that is used has 8 criteria: relevance of the operation for research (relevance of the opportunities identified by the students) (10), the estimation of the results that could be achieved (the estimation is based on the student's analysis of the company's situation and its acceptance by the entrepreneur) (10), information gathering (respect to institutional principles, respect for the environment, gender) (10), the construction of the mathematic model (definition of variables, construction of restrictions) (15), its resolution and the sensitivity analysis (Thoroughness during result interpretation, creativity and comprehensiveness on the sensitivity analysis) (20), the preparation of the proposal (coherence and fesability) (25), the preparation of the document (completeness, ortograph) (5), and the presentation of the results (security, use of time) (5).

- Entrepreneurs cooperate with the monitoring of the process criteria, the relevance of the opportunities identified by the students, the respect to institutional principles, respect for the environment and gender approach.
- The professor monitors the quality of the model, the comprehensiveness and relevance during the information gathering process, the thouroughness of the analysis of the results and the creativity and comprehensivess of the sensitivity analysis
- The entrepreneurs and the professor evaluate the result criteria.
- The students assess their progress on all regards

4. Execution and results

Table 2 shows the results of the experience, including the number of registered students, those who managed to develop the competence and the companies in which they worked. As of 2016, two more groups were increased per semester.

Table 2. Results of this experience

Year	Number of students	Number of students approved	Number of groups	Number of companies
2014	96	93	29	27
2015	93	82	27	27
2016	171	138	44	42
2017	197	189	61	60
2018	197	191	62	62

Source: Elaborated by the author

As part of the preparation phase, each semester, it was important to find small companies that were willing to receive the students groups and give them the information that would allow them to undertake their research. Afterward students chose the problems they would tackle during the semester. The solutions to these problems would support and complement the execution of the research and the transfer of what they learned.

The presentation of the methodology for the course caused different reactions in the students: interest for a different approach, motivation about participating in decision making spaces in regards to the problems to face.

The development of the theory from the experience was another novelty for students and was the most difficult part to assimilate for them. Having to do the analysis and estimations before applying a formula made them feel insecure, and it was important to motivate them continually. WhatsApp was a good tool for this, and in some cases, individual communication could be useful.

Halfway through, there is a written evaluation about the process, what they learned, the difficulties and how to improve the work. The enthusiasm is general. The causes, according to the students are: the importance of being responsable for their learning, working on national issues, the challenges they fase and feeling useful to provide solutions to real issues from outside entities.

Conversely, there is always one or two students who feel uncomfortable with the method used, and who express their desire to go back to the traditional method: "Why does the professor not do his job? We pay him to teach, not for him to make us do what he should be doing" said a student once. In every case, these students said that theory should always be tought before practice; they said that they felt bad about facing situations without the necessary tools. This position was contested enthusiastically by their fellows. The final evaluation of the course presents suggestions made by the students on operational aspects, such as having more time, having the opportunity to change groups in the middle of the semester, having more classes per week and working on more examples.

The experience in the companies has been positive, both for the companies and the students. The competency was developed to the expected level. The most important indicator was the acceptance of the proposal by the companies, and this happened in almost every case. From over one hundred companies, only three rejected the proposals made by the students.

At the beginning of the students' intervention, the companies show lack of trust and difficulties to share information; but this attitude changes as the weeks pass and they perceive the role of the students as mutual collaboration.

In all cases the companies' representatives expressed their gratefulness to the University for giving them the attention and support in their management. They also showed their satisfaction for the students' behaviour and because their research allowed them to see solutions to their problems that they had not perceived.

The evaluation uses information from the companies' representatives, the students and the professor,

The reports prepared by the companies about the work of the students is honest and, in some cases, quite severe. They show the detail about attendance, punctuality, treatment of workers, the accuracy of their observations, the pertinence of their decisions and the

viability of their final proposal. In five cases the companies have tried to recruit the students to strengthen their teams, happy with the work they did and because the proposals had helped improve their performance. The students' self-assessment shows that they feel they developed the competency according to the expectations.

In the last 4 years, there have been ten dissertations that use Operations research as a main issue, although over 500 students have been working with this new methodology.

5. Conclusions

The most important conclusion is that using different methods to the usual has allowed the development of a profesional competency on Operations research, to the desired level, in students from different fields. The second is that, by interacting with small companies, it is possible to show that ther are powerful tools that, if used appropriately, can help improve their performance.

On the other hand, involving students in Operations Research for their learning has proven to be an important motivating factor, as well as the incorporation of mechanisms of self-regulation helps them control the quality of their work.

As for the role of the companies' representatives, it has been very effective, and has contributed to the training and evaluation of the students. This different way of teaching mathematics can serve as an example for other courses in which mathematics is essential.

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The acquisition of transversal competencies through a Youtube channel

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Abstract

This paper aims to expose the results of the multidisciplinary teaching innovation project approved and developed at the University of Zaragoza during the academic year 2018-2019 by professors of different knowledge areas, in particular, administrative law, civil law, commercial law and procedural law.

The (main) objective of the Project is that the students in Law Degree and in the Degree in Law and Company Administration and Direction who are in the involved sujects acquire, in an autonomous way, knowledge on the consumer law. Also, they should be able to divulge basic ideas in consumer law, through the creation of a video which will be uploaded in a YouTube channel created for that purpose

In this way, the Project intends that students can acquire basic and specific competencies described in the study program, as they can be: interpretation of legal texts from a interdisciplinary perspective, the use of ICTs as tools of work and information and, also, the acquisition of skills to transmit information to a public which can be specialized or non- specialized.

Keywords: Innovative materials and new tools for teaching; teaching and learning experiences; educational technology.

1. Introduction

This work aims to transmit the results after the development of a Project of Educational Innovation implemented in different subjects of Law Degree and Degree of Law and Companies Administration and Direction at the University of Zaragoza during academic year 218-2019. This project (PIIDUZ_18_29) was approved by resolution of the Vice-rector for academic policy.

The preparation of this project of educational innovation arises from the search by professors of different areas of knowledge of a mechanism that, within the teaching of their education, allows them to deepen in a branch of the law as is the «consumer law», characterized by its multidisciplinarity. The search for a mechanism to implement the study of the «consumer law», in the syllabus, arises after the abolition of an elective subject called «consumer law» after the implantation of the Bologna Plan, which allowed the students of last courses, the learning of this subject from a multidisciplinary perspective.

It has been considered that the development of a project of educational innovation consisting in the creation by the students of videos tutorials in which they explain basic concepts of «consumer law» and, their subsequent diffusion in a channel of Youtube created for the purpose, allows students to acquire several basic and specific skills of the qualifications involved in the Project.

The configuration of the project around the broadcasting of videos in a YouTube channel arises from the finding that the students usually go to the Internet and/or to videos of YouTube to solve their concerns and academic doubts.

It has been found that there are few videos for the resolution of legal questions or the explanation of basic legal concepts and those on the platform, usually present three drawbacks mainly: the first is that many of them are not refer to the Spanish legal system; the second, is that there is no continuity in related videos on a one subject and, the third is that sometimes the author of the video uses it with the objective of capturing clients for his lawyer's office and not so much for expose clear concepts.

Therefore, it has been considered advisable that students in law of different subjects and courses intervene in the preparation of informative videos all of them related to the same thematic, the «consumer law», and that they are directed to an audience.

In this way the students will accomplish an autonomous learning about the concept that has been assigned to them and also on the topics worked by the rest of their companions when they visualize these videos through the Youtube channel.

2. Development of the Teaching Innovation Project: the creation of a Youtube Channel

2.1. A multidisciplinary project on consumer rights

The reason why it was decided to develop a project of teaching innovation in this matter lies in the appreciation by different professors that there is a branch of the law, which is the «consumer law», that is not currently addressed in the syllabus. Training in this field requires the intervention of different areas of knowledge and the labour market is demanding professionals with training in this field.

The development of the project involved professors from the areas of knowledge of Administrative Law, Civil Law, commercial law and procedural law and, students of courses between second and fourth year of the degree in law and of the double degree of administration and direction of companies and law.

2.2. How has the teaching innovation project been developed?

1) *Coordination meetings between the teachers in the Project of Teaching Innovation:* during the development of the project of teaching innovation, different meetings have been accomplished among the members of the project, to address organizational questions as the concepts that were to be treated to avoid duplication, the duration and contents of the videos, number of students per group, incentives for participation, calendars for the deliveries of videos etc.

   The development of the project during an academic course causes the development of the videos to take place during the first and second semester, so that after the end of the first semester, there was a meeting between the members of the project, for the purposes of that the teachers who had already developed the project in their group exposed their impressions and difficulties, in order to make improvements during the second semester.

   In parallel, the channel was created on the Youtube platform to be able to broadcast the videos.

2) *Meeting with students interested in developing a Teaching Innovation Project.* At the beginning of both semesters, when the professors had commented on the project of teaching innovation in their different subjects and the students had shown their interest in participating in it, a joint meeting was hel with all students. These meetings were intended to explain the content and motivation of the Teaching Innovation Project. Also that the students of the different groups knew each other and became aware that it is a multidisciplinary project, in which they will deal with topics of a branch of the law but from different perspectives and

finally, to explain to them that the development of the project of innovation could affect image and intellectual property rights and third parties, which should be guaranteed.

3) *Meetings of the teacher in charge of each group with the students.* Subsequently, the students of each subject met with the teacher responsible of the same to determine the concept on which they were going to carry out their work, they were provided with a basic bibliography for the study of the topic and a calendar of Work.

   Prior to the recording of the video, students were to give the teacher responsible for the subject a script on the content of the video for review and, in the case, verify that intellectual property rights were respected and image.

4) *Video delivery, review, layout and publication on the platform*: Finally, each of the working groups sent to their respective teachers the videos for review and evaluation, and these were sent to the project coordination.

   In some cases, the intervention of the audiovisual service of the university itself was valued – having a part of the project, which could be used in this concept-to improve the layout and to equip all the videos with a certain uniformity.

   Finally, a schedule of publication of the videos has been established so, with a weekly periodicity, they are published in the channel. In this way, students check each week the channel to see the corresponding video.

   At the time of submission of this paper the Project is in this last phase. The videos are being reviewed by the university's own audiovisual service and, therefore, these videos have not yet started to be published on the channel.

2.3. Results

The main results of the Project are the following:

1) The participation of the students has been high, the project of educational innovation has been implemented in six groups, of the subjects of Civil Law, commercial law, administrative law, and procedural law and, in most of them have obtained 4 subgroups interested in participating in the Project, being this figure higher than the initially expected since the coordination of the project.

   In the subject that has obtained a lower participation of students (a group) due to a question of workload, because professors of other subjects had also implemented in the same group of students other projects of teaching innovation.

2) Students have independently acquired knowledge in the area of «consumer law». The preparation of the video has forced them to study the norms and the legal problems that arise around the entrusted concept, to extract the most important ideas and to be able to project them both in written and oral form.

3) Students have become aware of the interdisciplinarity that has the law as an area of knowledge and has enabled them to engage in relationships with students from different groups.

4) The audiovisual media chosen for the broadcasting of knowledge has made students have to use video and layout tools as tools for work and information.

5) The publication of videos periodically through the Youtube channel, has made the students who have participated in the project innovation teaching visualize the videos, acquiring knowledge on aspects of this subject that had not worked.

2.4. Difficulties encountered

The main drawbacks that have been appreciated in the development of the project of teaching innovation, are the following:

1) There is no uniformity in the groups about the video and layout tools. This skills are external of the degree in law and is in which greater disparity has been appreciated, because in the subgroups there have been students who were the first time that they used these tools and other students had professional training in video tools.

2) The configuration of the project through the diffusion of videos on a public channel of Youtube has made that some students have rejected the participation in the project because of shyness or qualms to be exposed publicly.

3) In connection with this, participation in the project must be strictly voluntary, after the students have been informed of rights that correspond to them. It has been conditioned the incentives of professors to ease the participation in the proyect.

2.5. Conclusions and future considerations

The work developed shows that the objectives for which the project arose have been achieved, since it has been considered an ideal mechanism to achieve some of the basic and specific competencies in the configuration of the University degrees in which the project has been developed.

In addition, the degree of satisfaction of the students after the participation in the project is high, emphasizing the innovation of the project and the acquisition of additional knowledge, that by a temporary question cannot be developed in the theoretical classes and practices.

2.6. Figures and Tables
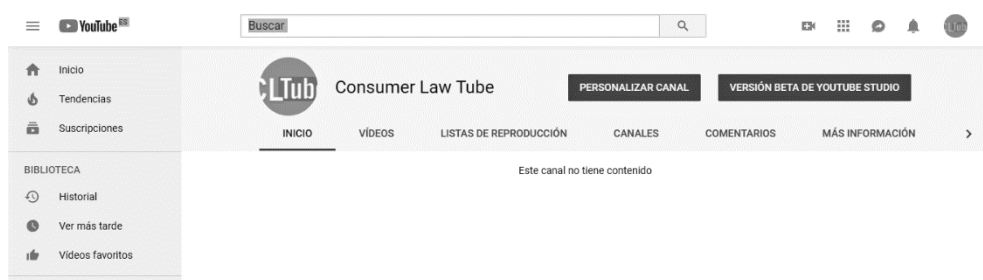
Figure 1. This is the image of the Youtube channel prior to the dissemination of the videos

Figure 2. This is the first image of one of the videos, in which the theme of the video is exposed.

Figure 3. Image of another of the videos, which exemplifies an everyday situation with transcendence for the «consumer law»

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The intricacies of developing a work readiness programme for South African Business degree students

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Abstract

Global research studies have shown that students perceive their academic qualifications as having a declining role in shaping their employment outcomes. While academic credentials are still seen as a significant dimension of their employability, students increasingly see the need to add value to them in order to gain an advantage in the labour market. To mitigate these concerns, a work readiness programme was developed to educate students about professional behaviour, dress etiquette and ethics necessary for the work place.

It is against this backdrop that undergraduate students in the Economics and Management Sciences Faculty were invited to participate in a pilot study to develop a work readiness programme. About eighty six Business degree students participated voluntary and attended several workshops hosted by human resources industry experts such as HR talent managers, consultants and directors. Students who successfully completed the programme doing an online assessment were automatically registered on a database to find short term employment in a business where they practice the graduate attributes for the world of work. The major challenges encountered while develop the programme were as follows: convincing employers to provide students short-term work placements and modifying the programme several times to suit both the student and employer.

Keywords: work readiness; undergraduate students; graduate attributes.

1. Introduction and Background

A baseline study was conducted on South African graduates from the perspective of employers by Higher Education South Africa (HESA) and the South African Qualifications Authority (SAQA, 2009). The purpose of the pilot survey was to take stock of the views and expectations of employers and their evaluation of the quality of graduates produced by South African Higher Education institutions. The study found that there is a need to increase a student's employability skills while still at university. These cover a multitude of issues from life skills to soft skills, from instilling a work ethic to personal initiative and that gaps between employer expectations and higher education outcomes need serious attention.

Another concern highlighted in a study conducted by Hinchliffe (2011) is that students perceive their academic qualifications as having a declining role in shaping their employment outcomes in what is perceived to be a congested and competitive graduate labour market. While academic credentials are still seen as a significant dimension of their employability, students increasingly see the need to add value to them in order to gain an advantage in the labour market. With graduate numbers increasing on a global scale, universities have a responsibility to promote the employability, work readiness and mobility of their graduates (Andrews & Higson, 2010).

This article reports on a pilot project that was conducted on a project that gives students the opportunity to find short term employment in a business where they can learn about their specific disciplines. In addition to this, students could develop soft skills and tacit knowledge of the workplace that is not necessarily embedded in the university's curriculum. Potential employers, on the other hand, will have the opportunity to access students' names on a database to assist them with administrative tasks (eg. data capturing, reception work, filing, etc) on a short term basis while giving students the platform to learn about their respective disciplines and developing graduate attributes.

2. Context of the study

The university where the study was conducted, is one of four higher education institutions in the Western Cape Province in South Africa. It was established by the apartheid government for coloured students and is currently classified as a previously disadvantaged university. This university was directly involved in the fight against apartheid and became known as the 'University of the Left' (Walker & Badsha, 1993). During the late eighties, the university allowed access to black students. Most of the students come from poor communities and underprepared public schools. The Economics and Management Sciences Faculty is the biggest faculty in the university, with more than five thousand students registered.

This project aims to give students the opportunity to actively participate in a real working environment that will give them the space to reflect on the concepts and skills taught at university. Moreover, to develop the graduate attributes that is not explicitly embedded in the formal curriculum.

Currently, eighty six students successfully completed this programme and are registered on a database to find short term employment. For example, a student could assist a business with preparing invoices for two days and in this way the student is learning about a specific operational element of a business and the opportunity to develop the attributes required for the world of work.

So how can employers connect with students? The first step is for the employer to submit a work request with the job specifications and period the student will be required to work. Thereafter, the administrator checks the database of students who meet the requirements. Following this process, the administrator sends the CV and contact details of the student to the employer. The employer is required to contact the student for an interview. After the successful recruitment, the employer is required to inform the university of the placement. The student must sign an employment contract and email a copy of the contract to the administrator. Upon the completion of the mandated work, the administrator sends an evaluation form to the employer and student to complete. The university will use this information and feedback to further improve and enhance the programme.

3. Aim and objectives

Based on the context given above, this article has one main objective and that is to develop a work readiness programme that gives students the platform to develop the attributes required for the world of work before they graduate. In order to achieve the aims and objectives, the main research question was: *What are the intricacies in developing a work readiness programme for students in a Business degree programme?*

4. Literature review

A study conducted by Van de Rheede (2012) found that employers' expectations of university graduates need more attention in the current university curriculum. Examples of these expectations are the importance of soft skills and independence of thought. Employers are of the opinion that graduates lack work experience and suggest that universities design and implement programmes that will give students the opportunity to gain practical experience in the world of work before they graduate. These types of programmes will address employers' expectation that graduates have work experience before they consider them for employment. A South African study of employers' perception of graduate

employability showed that 80% of their respondents (employers) indicated that the graduates they employed were not ready for the work place. It was also stated that graduates expectations of the workplace were not realistic to what is offered by the employer.

Employers regard work experience as an indication of what graduates are capable of doing beyond what is stipulated on their respective degree programmes. A report released by the South African National Treasury (2011) revealed that employers regard inexperience graduates as a risky investment. Employers need to give graduates extensive training before they can contribute productively to the business which discourages them to employ graduates without work experience. Findings in a South African study revealed that students who were exposed to practical training while studying found it easier to transition from university to the workplace. This study also highlighted that confidence can only be developed in an authentic working environment such as the work place and not while sitting in a classroom taking lecture notes (Van de Rheede, 2012).

5. Research methodology

The research design used for the pilot study was a case study design (Creswell, 2013; Stake, 2006; Yin, 2009, 2014). In accordance with qualitative research, a case study design assisted the researcher to understand and gain sufficient insights of the processes required to develop a work readiness programmes for undergraduate students (Stake, 2006; Yin, 2009, 2014). The researcher's approach in developing a work readiness programme is based on Yin's notion that work readiness is a phenomenon that encompasses the support students are given to develop the attributes required for the world of work (Yin, 2009, 2014). Thus, the researcher is of the opinion that the provision of a work readiness programme as an intervention strategy can be used to overcome the current challenges higher education institutions face to adequately prepare their students to meet employer expectations. .

6. Findings: What were the intricacies?

The pilot study was rolled out to second and third year students in the EMS faculty of the university at the beginning of the first and second semester in 2018. Invitations were extended to students and they were requested to respond via 'Google forms'. For the training session in the first semester, one hundred and twenty students responded favourably but only forty six students attended the session. While for the training session in the second semester, two hundred and thirty students showed interest but only forty students attended the session. Five industry experts hosted the workshops and students were required to complete an evaluation form after each workshop.

Numerous meetings were held with the university's Director of the Business Innovation centre to discuss the development of a business and process plan, given the fact that businesses would have to pay a nominal fee to access the database to employ students for short term work placement. A legal contract was also drawn up by the university's law faculty to ensure that the rights of the student and employer are adhere to.

The project also required media coverage and for this reason the researcher worked closely with the university's Institutional Advancement Department to create a short video advert of approximately two minutes to attract potential employers to be part of the programme. In addition to this an E-brochure was designed to distribute to employers. An administrator was employed to send invitations via e-mail to invite potential employers in the Cape Town region to join the programme. She sent a total of one hundred and thirty four invitations via e-mail. After a couple of days, very few responses were received and the administrator was requested to follow-up via telephone to check if these employers received the e-mail. Most employers acknowledged receipt and few opted to have a face- to -face or telephonic meeting with the researcher. Twenty two face- to –face meetings were held and five telephonic meetings. So far, only three employers signed up to join the programme.

The students' feedback of the initiative to start a work readiness programme in the faculty was overwhelming positive. Many of them indicated that this type of programme will equip them with knowledge of employer expectations and that more students in the faculty should be exposed to such programmes. Below is a table of their comments:

Table 1. Students' comments about the work readiness programme (Part 1).

- Overall an excellent and informative engagement
- it was well planned and it was well prepared
- Very useful information shared that every student deserves to know.
- Continue and find a way to touch as many students as possible
- It was a good experience. I learned alot!
- This is a good programme which I think more students should be aware of.
- This was more than I expected and actually got me excited for the work space. I learnt so much and I really want to do more and experience more. I believe it should continue
- Thank you to the EMS faculty for organising this programme, it is really informative
- The workshop has broaden my horizons in terms in terms of work-readiness, there should be more of these.
- These sessions were very helpful and I have gain more knowledge about the workplace
- The workshop was educating, I now know the things that I thought don't matter actually does matter.
- The course gave a very good insight on the preparations for the workplace, and developing yourself
- The program was very helpful
- The presentation was engaging and dealt with relevant issues.
- This workshop motivated me to put action into my plan in pursuing my goals
- The programme was very helpful as I now know and aware of what to expect in the workplace.
- The workshop was well informative and it has helped me to reflect on my career

While the student feedback was overwhelming positive, certain students also wrote that the workshop is too long and that industry experts should be invited to form part of the workshop presentation. Here are their comments:

Table 2. Students' comments about the work readiness programme (Part 2).

- Wish we had more time to go through the CVs
- They should invite managers from Accounting firms so that we can ask work related questions
- having employers or representatives from companIEs come in and speak would make the workshop more appealing
- The workshop is quite long and individuals gets tired close to the end. However, if the length of the workshop is shorter with the same amount of information being presented, it will be more beneficial
- The advise about not posting stuff on social media that will back fire you at the end
- We need more time to learn how to navigate the Xplora Tool
- Add some possible employers to talk to students

7. Conclusion

The development of a work readiness programme requires the involvement of numerous stakeholders. The researcher is of the view that the easy part of this project was to develop the proposal on paper. One of the challenges was the implementation of the programme which required the engagement of industry experts and several units such as the Business Innovation Centre and also the Institutional Advancement Centre. The major challenge so far, was the effort required to convince industry stakeholders to join the programme. An interesting finding is that all the stakeholders who the researcher had meetings with, agreed that this programme is vital to adequately prepare students for the world of work. In fact, some of them stated that they wished that such a programme was available when they did their tertiary studies.

The way forward, is to go back to the drawing board by contacting those stakeholders whom the researcher had meetings, to establish why their business did not consider joining the programme. This feedback will assist the researcher to reflect and modify the programme. To conclude, the ultimate vision is to create a module that provides students with the practical and theoretical knowledge to equip them for the world of work before they graduate.

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A Class of Nothing

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Abstract

Imagine a class with no syllabus, no teacher, no instruction, no method, no homework, no assessments, no grades, no 'classroom'. What could that be? 'A Class of Nothing' is a radical pedagogical concept that stems from the need to create space. Physical space. Mental space. Space in time. Through the idea of nothing as a starting point, and no-instruction as a pedagogical tool, 'teacher' and 'student' immerse in a space of waiting, of disconnection from the outside world, and eventually, of discovery and making. In the space of 'A Class of Nothing' to educate means no more to teach, give, or exemplify: to lead out; but to inhabit, to experience: to let in. The concepts of teacher and student become blurred, and it is no longer possible to understand them in the traditional sense. Responses from students to various 'classes of nothing', reveal that this kind of experience is new, intriguing, mind boggling, unusual, surprising, interesting, strange; it places them in a different *space: physically, mentally and in time. This paper introduces the notion of 'A Class of Nothing', and provides the reader with a number of examples where this concept and approach have been applied.*

Keywords: *Radical; Pedagogy; Nothingness; Nothing; Practice as Research; PaR.*

1. Pre-liminary Thoughts

Imagine a class with no syllabus, no teacher, no instruction, no method, no homework, no assessments, no grades, no 'classroom'. A class that does not start, and that does not end. *A Class of Nothing*. What could that be?

A Class of Nothing is a radical pedagogical concept that stems from the need to create space. Physical space. Mental space. Space in time. Students nowadays do not take time to do nothing, to be present, to share a space. We are too self absorbed, too focused on ourselves that rarely our actions form an uninterrupted continuum. Everything has to have a purpose. But we often forget that purpose does not always have to be pre-conceived or intentional. We expect too much, even though what is clear in this information-rich, virtual, digital era, is that it is never clear what to expect. We are constantly looking for satisfaction, to be satisfied by what we are shown or given. Being full of expectations limits possibility and somehow negates learning. If we expect nothing, we benefit from anything. We want to know, but often we do not really know exactly what. We want to understand, but end up confusing understanding with the processing or memorising of information. Everything now is information, but often we do not know what to do with it.

The new order of knowledge I propose as part of this *Class of Nothing* is not based on the processing or synthesising of information, but precisely on the non-intentional processing of what we observe. It is not about amounts or demonstrable outcomes, about how much we learn or not. Nothing is immeasurable. And so it is this new order of knowledge. You do not go to *A Class of Nothing* to learn about mathematical principles, or law, or engineering; although that could eventually take place. You go there precisely not to learn about that, but about what that is not. The new order of knowledge is in between the gaps of current understanding; and both permeate, inter-penetrate each other, although that is not always apparent. *A Class of Nothing* is an experience of possibility, discovery and clearance; not about pre-defined, factual outcomes. Clearance here is understood as the act of clearing from previous or existing technical knowledge. A clear space. A clearing. And the permission to discover and wonder. *A Class of Nothing* is about nothing in particular. Distractions are potential creative pathways. Distractions are welcome: they become a form of knowledge.

Nothing is not a precise thing. It is too big. Too big to see. Too big to feel. Too big to understand. It has no beginning and no end. It is pure space, unfathomable. Nothing is at the core of creativity, and one could argue that it is its principal instigator. Creativity stems from nothing, and ultimately leads to nothing.

2. An Experimental Approach

Throughout my career as an artist and lecturer in music and contemporary arts practice in Ireland, I have come to the conclusion – through the careful observation and analysis of my teaching, and the overall student experience in both academic and practical modules – that students tend to do things in automatic, almost always aiming to fulfil the requirements of their course with little or no consideration for how all the learning they experience is actually applied in life. It is as if learning is just another one of those daily routines that they have to follow in order to go on with their own lives. This is a preoccupation I have had for a number of years; and after working on different ideas and methods, I came to realise that what students needed was *Space*. That led me to develop the concept of *A Class of Nothing*. If students took at least one hour per day as part of their curriculum to just be, to aim for nothing, perhaps to do nothing as well, then that *Space* would eventually emerge and manifest itself physically in space and time, and become enhanced creativity, new knowledge and new forms of learning, making and doing.

Learning and knowledge in the West have been historically associated with action and (intentional)-action-based processes. Proof of this is the present curricula in 1st-, 2nd- and 3rd-level education in Ireland (including 2nd- and 3rd-level education in the arts) – and I would dare say in many other countries in Europe and beyond – which are mostly based on the acquisition and development of action-based knowledge through action-based learning, or the performance of intentional physical and/or mental (intellectual/rational) actions. In the case of the Western arts, artists such as Robert Rauschenberg (1951), John Cage (1952 and 1959), Yves Klein (1958), Gustav Metzger (1959), Mary Ellen Carroll (2006) and Marina Abramović (2014), amongst others, have employed the idea of nothing and the concept of nothingness as means to create art objects and experiences that develop from non-intentional action. This has changed the way we understand and perceive art: it has produced new ways of knowing. Similarly, *A Class of Nothing* aims to develop a new order of knowledge – one that is constructed through initial non-action and no-instruction – which would produce an enhanced sense of awareness, and thus create new ways of understanding and interacting with the self and the world.

A Class of Nothing represents a good example of how arts practice research can inform, influence and inspire pedagogy, and how innovative pedagogical methods and practices may develop from an artistic idea. Since any artistic endeavour is, at the start, necessarily empirical and ephemeral in nature – as have been from the outset many of history's most respected scientific undertakings – any attempt to use theory to frame, inform or dialogue with what is being proposed here at this point may compromise its purpose, understanding and practical application – I specifically refer to theories that originate outside of the realm of the practice that is being outlined in this paper.

Notwithstanding this, the paper and the practice itself are grounded in a series of long-standing works and approaches developed through history by artists, writers and philosophers. These works represent not only a point of departure for the ideas and examples presented and discussed here, but also a radical and inspirational reference that is both inherently theoretical and practical. In other words, the works referred to here are indeed theory, just not of the same nature and form as that found in more traditional pedagogical writings and related academic undertakings.

2.1. First experiment: Aldeburgh Music

The first time I experimented with the concept of *A Class of Nothing* was in the summer of 2015, during an artistic residency at Aldeburgh Music, in Snape, England. I did so with a group of about 25 of the most talented and promising young musicians of the UK, aged 11 to 19. I did not know what to expect. I did not have a clear idea of what I was doing or where I was going with it. All I said to the students was that it was 'a class of nothing', and that we were going to wait for an hour and see what happened. And so we waited, doing nothing in particular. Some were seated, some standing. There were no rules whatsoever. Everyone was free to just be, in that moment, together, without expectations of any kind.

Then, out of nothing, one of my colleagues – who was there to teach during the residency – threw a ball on the floor that he had made with a piece of paper. He did it gently, but intentionally, as if aiming at a 'non-existent bin'. And that was 'all that was needed'. It created a storm of activity of all kinds. How one thing developed into another, I cannot recall, nor do I think it was entirely clear. It simply went from apparent non-action to full activity. Noises here and there, running all over the place, shouting, people talking to themselves and to others, laughter – some nervous, some simply out of joy or some unidentified impulse – collaborative music making, improvisation, reading/sounding of texts, dancing, walking, pianos, violins, guitars, drums, oboes, clarinets, harps, flutes, voices: all sort of instruments being banged, played, used as devices to create meta-sonic stuff. It was a deliciously and carefully-constructed chaos. A chaos that emerged out of nothing. Out of non-activity. Out of many things.

This first experiment was successful in as much as it was about nothing. And it was succesful because it rapidly became a source of creativity of the most indescribable kind. It was art in different manifestations: music, dance, theatre, festival, poetry; but with undefined boundaries. It was learning and knowledge of a new order. It remains in my memory as one of the most bizarre, yet unforgettable teaching experiences I have ever had. A true and radical pedagogical experiment.

2.2. A second experiment: Coventry University

As part of an ERASMUS exchange between the University of Limerick in Ireland, where I work, and Coventry University, in the UK, I was invited in 2016 to lead a residency in the latter's Department of Music. One of the sessions I was to have was with the music education students. The opportunity could not have been more suitable. I decided to do *A Class of Nothing* with them. For this, I prepared a written poetic reflection that I was going to read once the students had entered the space (classroom/performance space). This was going to be accompanied by projections of different art works connected with nothing and nothingness: works by Robert Rauschenberg (1951), Yves Klein (1958) and Gustav Metzger (1959) were shown.

The class entered and gathered on the floor. I had previously asked their teacher to sit with them and just 'do nothing'. For a period of time the students were chatting about different topics. Some were aware of my presence, and the presence of the work being projected on the screen. The chatter continued for a while until it eventually died out slowly. I waited. Then I proceeded to read as if I were on my own in the room. This created a sense of intrigue and confusion to a certain extent. Once I finished the reflection I had written for the occasion, I waited. After some time passed, I went towards the door, and on my way to it I banged a few notes on a piano that was nearby. I went out, said hello to a lady that was doing some cleaning, and went back in again. Nothing much happened. It was contrastingly different to the experience in Aldeburgh, but no less successful. It had achieved what I had aimed at: nothing; and as a consequence, a great deal of something.

Later, I sat with the students and their teacher, and – after some silence – I started to ask questions about the experience. The discussion that ensued was very rich and inspiring, full of insight and reflection. This is what the teacher wrote about it afterwards:

> A very thought-provoking class. From confusion and uncertainty, the group blossomed slowly but surely into a collegiate collective, open-mindedly discovering and learning from a starting point of nothing. This reframed the initial feelings into material for self-awareness and reflection on the ethics of teaching and learning, indeed of society itself. This was a radical pedagogy, ideal for a module in music education. Óscar facilitated with a mixture of poetry, visuals, performance and pedagogical skill – starting with nothing, rather than instruction, and ending (but not really ending...) with a sense of possibility and empowerment, rather than a purely technical outcome. (Habron 2016)

Both the experiences in Aldeburgh Music and Coventry University gave me the insight, strength and confidence to continue developing the concept of *A Class of Nothing*, and to continue experimenting with it in different situations and contexts. These are summarised in the next section.

3. Further Presentations and Experiments

In April 2016 I had the opportunity to present the concept of *A Class of Nothing* at the Arts-in-Education National Day in the Irish Museum of Modern Art in Dublin. This was organised by the Arts in Education Portal, which is 'the key national digital resource of arts in education practice in Ireland…launched in May 2015 as an initiative of the Department of Education and Skills and the Department of Culture, Heritage and the Gaeltacht' www.artsineducation.ie. I created a performance art-like experience for those who attended my 'talk', and read and performed from a reflection I wrote for the occasion. I also showed images similar to those I used during the session in Coventry University. The public attending consisted mostly of educators and people interested in the field of pedagogy. There were also artists and gallery curators present during the talk. The questions, reactions and subsequent discussion left me feeling very positive and stimulated, which showed that the concept was strong and worth exploring further.

I have also offered *A Class of Nothing* to students of Irish Dance and Voice and Dance at the Irish World Academy of Music and Dance in the University of Limerick. For one of the occasions (with the latter group), I created a set of 10 'rules' (which I titled 'Rules (some)'). I read these rules at the start of the class and then told to the students that I was not going to say anything else. The rules were: 1. Talk to yourself; 2. Don't talk to others (unless you need to say nothing); 3. Come and go as you please or need; 4. Do as much or as little as you want or need; 5. Don't fall asleep (try); 6. Don't zone out (try); 7. Be patient; 8. If you have any questions, don't ask (unless you know); 9. I'm not here to answer questions – like you, I'm here to formulate them, and try them out; 10. Don't waste time.

Like the very first experience of the *Class of Nothing* in Aldeburgh Music, the class was full of everything: noises, talking, singing, dancing, shouting, people leaving the classroom and coming back, people sitting and doing little or nothing, people watching, waiting, in silence. Interaction. Contemplation. Nothing.

Once more, this class was a success in as much as *nothing in particular* was accomplished. Nothing: a lot of things too. New learning, new understandings. A great number of interesting and stimulating questions emerged after the class (as I normally dedicate a considerable amount of time in each class to discuss what happened). It helped the students question things they never questioned before, or that they took for granted. The very concepts of nothing and nothingness were seen and understood from different and fresh perspectives. Here are some of the thoughts the students shared in their journals (their identities have been kept anonymous for ethical reasons):

> This class was very mind boggling. In a way it felt that everything that I was doing was right and wrong at the same time…[A]s the class went on it was apparent that nothing meant different things to everyone. (Student 1)

This was by far the most unusual thing I've had to do thus far. Uncertain of its actual outcome. I worked on different ways to do "nothing"…Soon enough the harder I tried the more I realized I was actually doing "something". (Student 2)

After some classes I was encouraged to question my perspective of different things for instance, the "class of nothing"…I have begun to wonder is there such a thing as "nothing" or is it just a word and actually non-existent. (Student 3)

When we had the class of "nothing", I didn't know how to react…Everyone around me is in their own world, all going mad!…From this class I noticed how much I overthink things, perhaps if we were to do this class all over again I would do it very different and do my best not to think and just let the class flow. (Student 4)

We were given the rules and then it was up to us – to do nothing and something…I felt so strange. Rarely are we asked to sit and do what one wants to do…I think my mind went into shock at being told it was a class of nothing and instantly one feels that something should be done! At one point, people started to move and then sounds and comments were emitted from people who were straddled all around the room…The 'class of nothing' had changed into 'everything' as everything happened…It was a very strange afternoon but intriguing… (Student 5)

It was something that we had never experienced before and I believe that it made me see a varying perspective into the world of improvisation… (Student 6)

Overall, I found it incredibly difficult to do nothing. I found that I was constantly fidgeting for no reason. (Student 7)

It was strange because this class went against all the classroom rules that we have grown up with since childhood…I think that I was nervous to explore outside of the norm. (Student 8)

Some people just assumed that talking was not allowed and were suprized then when [one student] broke the silence and Oscar responded by laughing, this made laughter okay in the class of nothing, so the laughter continued…there are unknown limitations, you never know what will happen. In a class of nothing there is no negative or positive, things just simply are. (Student 9)

I found it strange as I presumed, we were supposed to be sitting there in silence and listening to our thoughts. Why did I presume this? When other people began to speak/sing their thoughts aloud it encouraged me to then speak. Although I could have stayed in silence for the full process. (Student 10)

4. Conclusions

What is evident from the students' words above, and from the reactions and feedback received during other *classes of nothing*, is not only that this kind of experience is new, intriguing, mind boggling, unusual, surprising, interesting, strange; but that it places them in a *different* space: physically, mentally and in time; and this translation from being in a classical classroom situation – with all the rituals and behaviours that that entails – to being in a space of nothing, an open space, a space of possibility and play, enables them to not only view things differently, but to question what that they do in a classroom (and not), what they learn (and not), what the usefulness of it all is, what it means to be creative, to wait, to do nothing, to be in a space of nothing, to be part of that nothingness. Although this concept has been so far applied within the performing arts education sector at 3rd level, the approach could be implemented at all levels and in all disciplines. It could eventually be extended to other learning media, such as online and/or blended education, although it is important to highlight the performative nature of the concept.

No matter the responses or reactions one may have to this proposal, what is clear from the observations reported here, is that the radicalness at its core displaces, pushes, enables, overflows. It also creates something. Something new. Something vast: rich and barren. And nothing, too. After *A Class of Nothing,* nothing is never going to be the same. The same *nothing*. Never nothing ever absent. Never fully present. For when nothing is expected, we benefit from everything. In the words of Samuel Beckett (1954), 'Nothing to be done', and in those of Lao Tzu, 'When nothing is done, nothing is left undone'.

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Visualizing constructive alignment in the process of course design

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Abstract

Course design in higher education is often approached in a very linear and text-based manner. The paper presents a visual tool in the form of a canvas aimed at accompanying teachers in the design of courses. The canvas can be used in an individual or co-teaching setting. It can be applied either during the conception phase of a new course or to revisit and reflect an existing course.

The visual dimension departs from the usual text-based format and ambitions to offer a practical and intuitive approach. It aims at engaging teachers to adopt a prototyping approach in the design of courses. It builds on the various visual modeling tools offered in the fields of business and strategy.

The proposed canvas is part of a broader project accompanying higher education teachers in the clarification of their pedagogical intent, in ensuring constructive alignment and in the adoption of a reflexive posture on their teaching experiences.

Keywords: *visual approach; constructive alignment; course design; modelling*

1. Introduction

Many of the "classic" handbooks addressing teaching in higher education (Davis, 2009; Diamond, 2008; Fry et al., 2015) cover very extensively course design, including intended learning objectives, teaching strategies and assessment strategies. They usually do so in a very linear and text-based manner. Such format can be daunting for seasoned and non-seasoned teachers considering creating a new course or revisiting an existing course.

This paper presents a visual tool to support course design in higher education. It aims to offer a practical approach encouraging teachers to design their courses by mixing both intuition and constructive alignment. As such the proposed approach is both non-normative and non-descriptive.

The paper is structured as follows: after introducing the underlying pedagogical philosophy of the approach it describes the merits of a visual approach; the four blocks of the canvas and the contextual elements are then presented; the "mechanics" of the approach are described as well as a number of a use case scenarios.

2. A student-centered and teacher-focused approach

The underlying pedagogical philosophy of the approach draws from the work on constructive alignment carried out by Biggs (2003) and Biggs and Tang (2011). In the same vein, the course design canvas links learning outcomes, teaching strategies and assessment strategies. It also caters to teachers by integrating the course's actual content and embedding the course in a broader context (Sylvestre & Maitre, 2018). Indeed, a given course always takes place in a particular context. These contextual elements can eventually add constraints to the design of the course. As such it allows the teacher to focus on his/her immediate concern (i.e., designing a course) without disconnecting it from the realities of higher education (e.g., the resources available, the audience, etc.). The originality of this work compared to the usual representations of constructive alignment is that it integrates elements related to the context of teaching and learning.

3. A visual approach

Paraphrasing Larkin and Simon (1987), "diagrams are (sometimes) worth a thousand words". In fact, diagrams, models and other visual representations are often found in the course design literature. They seldom lay at the core of the approach. In addition, visual supports are mostly used to describe/illustrate concepts and constructs. The positive impact of pictures and visual representations on learning has been mentioned for a long time (Nelson et al., 1976) and remains a very interesting for education (Bobert & Tversky, 2016; De Santis et al., 2016).

Visual representations can be used to improve collaboration (Brand, 2017) or communication (Kernbach et al., 2015) to name a few.

Visual approaches to course design in higher education can be found in Bosschaert et al. (2016) or to a lesser extend in the RASE – Resources, Activity, Support and Evaluation) – model (Churchill, 2006; Churchill et al., 2016). Additional examples of curriculum design templates can be found Wiggins and McTighe (2005).

Both canvas and approach presented in this paper draw inspiration from the business model and value proposition canvases proposed by (Alexander Osterwalder et al., 2014; Alexandre Osterwalder & Pigneur, 2009). Such visualization and modeling have been present for some time in the strategic management literature and have increasingly been used in corporate settings (Eppler & Platts, 2009; Platts & Tan, 2004).

4. The 4 blocs of the canvas and the context

The core of the canvas is composed of 4 blocs (see figure 1):

- Learning outcomes – the skills that the student must master at the end of the course, the session or the program
- Content – the material that the teacher aims to transmit
- Learning strategies – the means to teach the learning outcomes; these strategies can be rather student-centered (e.g., reflexive questions) or teacher-centered (e.g., *ex cathedra* lecture)
- Assessment strategies – the means to ensure that the learning outcomes were reached
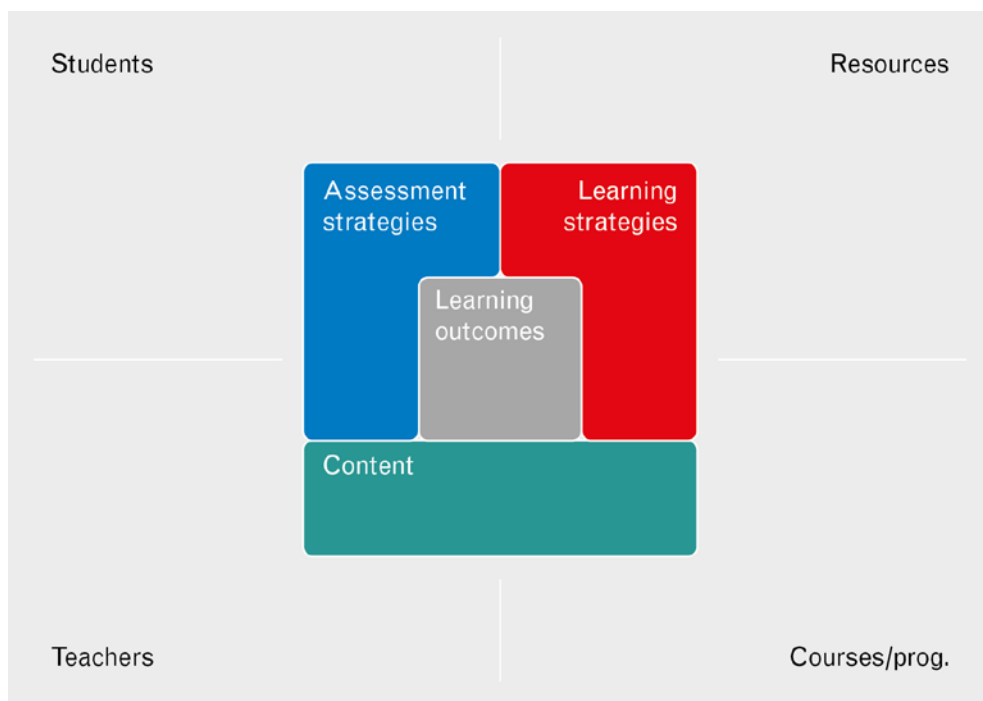
Figure 1. Course design canevas. Source: Lanarès et al. (forthcoming).

A mentioned above, a course always takes place in a particular context. These include:

- Students – homogeneity/heterogeneity, size, level and profile of the audience
- Teachers – expertise regarding the content, teaching expertise, incentives to teach
- Courses – where does the course fit in the overall curriculum, whether the course is elective or mandatory, whether there are credits or not attached to the course
- Resources – financial, logistical (e.g., rooms and material) and human (e.g., availability of teaching assistants)

In addition to those listed above, one can find additional constraints specific to a given course environment such as regulations relative to credits (e.g., ECTS), relative to accreditation (e.g., NQF) or institution-specific regulations. One must also often factor in institutional philosophies (e.g. vision and values), consider whether the course takes place in an institution with more of a theoretical or practical focus. Visually, the course design canvas is therefore embedded in a context. In addition, the 4 blocks are represented in a puzzle-like fashion to emphasize their reciprocal integration.

5. Use scenarios and "mechanics"

The canvas can be used in different cases including individual teaching, co-teaching or as part of a program. One can also imagine using the canvas to communicate with students, providing them with an integrated view and thus allowing them to better understand the links and logic between learning outcomes, content, teaching strategies and assessment strategies.

One starts by setting intended learning outcomes (ILOs) and content. This can be done either by writing a set of ILOs on post-it notes or directly in the canvas. In practice, one often starts by identifying suitable content and working "backwards" to transform content into ILOs.

As discussed above, contextual elements also have the potential to frame content and learning outcomes one. One is therefore encouraged to answer a number of questions in relation to the students, the resources, the course and the teacher. For instance, regarding content, one could ask whether the course is linked to other courses, what students already know (or are supposed to know) on the subject, how the content is related to a teacher's existing research interests. Regarding learning objectives, one could ask whether the course is rather practical or theoretical, how homogeneous the audience is, what time is at disposal.

One shall bear in mind that there is usually a back-and-forth process taking place when committing to ILOs and content. What really matters at this stage is to ensure coherence between content and ILOs.Once content and ILOs are defined, one then fills the teaching strategies block, followed by the assessment strategies. It goes without saying that there are plenty teaching strategies one can envisage; the same applies to assessment strategies and one shall choose those most adapted to the intended learning outcomes and to the content. Completing this allows to check to what extent ILOs and assessment strategies are aligned and eventually revisit the content and teaching strategies envisaged.

6. Conclusion

The paper presents a visual tool aimed at supporting course design in higher education. The canvas is the (first and) central element in a set of tools aiming at accompanying teachers in taking a more intuitive and practical approach to course design while at the same time ensuring constructive aligment. It can be used both when designing a course from scratch or when reflecting on an existing course and is aimed both at new and experienced teachers.

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Attitude towards and Interest in Dog-Assisted Interventions of Students in Higher Education

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Abstract

The mental health of students is a critical issue facing institutions of higher education, as a majority of college and university students report suffering from stress and anxiety. Studies have shown that interacting with animals can enhance the mental health. Consequently, animal-assisted interventions can be used to cover the concerns of students. This study evaluated German university students´ attitude towards dogs, animal-assisted interventions and their interest in its use at their own university. Additionally, possible predictors were investigated. Another aim was the validation of the questionnaire. 560 university students answered a questionnaire consisting of the Coleman Dog Attitude Scale (C-DAS), a modification of the Attitude Towards Animal-Assisted Therapy Scale and a translated and modified version of the Cuestionario de Actitudes ante las Intervenciones Asistidas por Perros (CAINTAP). Results showed a slightly positive attitude towards dogs, animal-assisted interventions and interest in its use at the university. Furthermore, students´course of studies and sex have proven to be predictors. Thus, especially female students of educational science would welcome an implementation of animal-assisted interventions at the university. The questionnaire showed high quality with a Cronbach's alpha α = .936.

Keywords: Animal-Assisted Intervention; Higher Education; Attitude; Interest

1. Introduction

Going to college or university is a new chapter in any person´s life. There are a lot of things changing and new challenges appearing. Students can experience elevated stress levels and anxiety due to new teaching methods, academic pressure, external and internal expectations, time and financial management, new social environment and geographic locations (e.g. Miczo, Miczo & Johnson, 2006; Misra & McKean, 2000). As a consequence, a lot of students suffer from mental health problems. According to an American College Health Association survey of more than 63,000 students in spring 2017, 87 percent of students reported feeling overwhelmed by their workload, 84 percent felt exhausted, 61 percent felt overwhelming anxiety and about 45 percent rated their overall level of stress as "more than average stress". An increased stress level in students in higher education was found in Germany, too. According to a study of the health insurance company AOK in 2016, the stress experience of students is still more distinctive than the one of the average of employees (Herbst et al., 2016), which is in line with the findings of Eskin et al. (2016), who reported a higher psychological distress in university students than in the general population. The stress level increases upon entry to university and does not decrease throughout their time there (Bewick et al., 2010).

To keep up with the increasing need for counseling service and to address the concerns of college and university students, finding new alternative ways to help has become paramount. One service that is increasingly used to meet the needs of students are animal-assisted interventions. An investigation by Haggerty and Mueller (2017) found that 62 percent of the surveyed universities in the United States already have animal-assisted programs and the majority of them use dogs. In animal-assisted programs commonly a group of students gets the chance to interact with therapy dogs and their handlers in drop-in-sessions. Previous research has revealed that those interventions can, amongst others, reduce students' stress (e.g. Binfet, 2017; Ward-Griffin et al., 2018), anxiety (e.g. Grajfoner et al., 2017; Jarolmen & Patel, 2018), homesickness and can increase their satisfaction with life and connectedness to campus (Binfet & Passmore, 2016). Nonetheless, animal-assisted interventions have not been used at German universities thus far. As a consequence, the aim of this study was to examine German students´attitude towards dogs, animal-assisted interventions and interest in its use at their own university. To gain more information, possible predictors were investigated additionally. It was hypothesized that:

1) German students have a positive attitude towards dogs, animal-assisted interventions and its use at their home university.
2) Sex and course of studies influence students´ attitude towards dogs, animal-assisted interventions and its use at their home university.
3) Age has no influence on students´ attitude towards dogs, animal-assisted interventions and its use at their home university.

Furthermore, the created questionnaire should be validated.

2. Attachment Theory

The relationship between animals and humans, and their effect on them, can be explained by the application of the attachment theory. The attachment theory (Bowlby, 1973, 1980, 1982) is an empirically supported framework that explains how close relationships influence emotion regulation, mental health, and psychological growth. It can be applied to relationships that meet four criteria (e.g., Hazan & Shaver, 1987; Hazan & Zeifman, 1994): proximity maintenance, safe haven, secure base and separation distress. As pets often meet these four prerequisites for an attachment figure/object, the human–pet bond can be viewed as an attachment relationship (Zilcha-Mano, Mikulincer & Shaver, 2011). Additionally, there may be secondary or context-specific attachment figures. Unlike primary attachment relationships, they might be more time-limited and situation-dependent. For example, therapists in therapeutic settings (Mallinckrodt, Gantt & Coble, 1995) can be actual or potential sources of comfort and support. According to Triebenbacher (1998), behaviors such as following, smiling toward, holding, and touching are evident in the reciprocal relationship between child and attachment figure, which can be observed in interactions between humans and animals, too. In summary, animals in visitation programs might also serve as attachment figures/objects and offer the benefits derived from them.

3. Methods

3.1. Participants

560 students of the University of Regensburg in Germany ($N_f = 408$, $N_m = 144$, $N_o = 8$), with a mean age of 20.90 ($SD = 2.742$, range 16–40) participated. The course of studies varied between teaching profession for primary schools "Grundschule" ($N = 160$), teaching profession for elementary school "Mittelschule" ($N = 72$), teaching profession for secondary school "Realschule" ($N = 41$), teaching profession for grammar school "Gymnasium" ($N = 129$), educational science "EWS" ($N = 105$), and single others like media studies.

3.2. Questionnaire

A questionnaire was created based on the Coleman Dog Attitude Scale (C-DAS), the Attitude Towards Animal-Assisted Therapy Scale and a translated version of the Cuestionario de Actitudes ante las Intervenciones Asistidas por Perros (CAINTAP). Furthermore, demographic information was gathered at the beginning of the questionnaire.

Demographic Information. Demographic information was asked to gain knowledge of students´sex, age, course of studies and semester.

Coleman Dog Attitude Scale (C-DAS). The Coleman Dog Attitude Scale assesses attitudes towards dogs. It is a 24-item self-report measure and has shown to be reliable and valid with a Cronbach´s alpha ranging from 0.98 to 0.99. (Coleman, Green, Garthe, Worthington, Barker & Ingram, 2016).

Attitude Towards Animal-Assisted Therapy Scale. Consisting of 19-items, the Attitude Towards Animal-Assisted Therapy Scale measures the attitude towards animal-assisted therapy. The questionnaire showed a high internal consistency with a Cronbach´s alpha α = 0.85 (Hightower, 2010)

Cuestionario de Actitudes ante las Intervenciones Asistidas por Perros (CAINTAP). The Cuestionario de Actitudes ante las Intervenciones Asistidas por Perros (CAINTAP) consists of 22-items, measuring the attitude towards dog-assisted interventions - perceived benefits and fears. It is separated in two factors, positive and negative attitude, both with Cronbach´s alphas α > 0,87 (López-Cepero Borrego, Perea-Mediavilla, Tejada Roldán & Sarasola-Sánchez-Serrano, 2015)

Due to its use at the university, some questions had to be modified for this context. The resulting questionnaire consisted of 24-items measuring students´attitude towards dogs and 20-items measuring their attitude towards animal-assisted interventions on a 7-point scale with 1 = strongly disagree and 7 = strongly agree, and closing 22-items measuring their attitude towards dog-assisted interventions at their home university on a 5-point scale with 1 = strongly disagree and 5 = strongly agree.

3.3. Procedure

The questionnaire was handed out to students at the beginning of different lectures. They were told, that this study was part of a thesis and participating was absolutely voluntary and anonymous. After about 15 minutes, the completed questionnaires were collected again.

4. Results

The program SPSS was used to analyze the data. A total of 548 valid questionnaires were obtained.

4.1. Validation of the Questionnaire

Principal component analysis (PCA) showed - analogical to the factor analyses carried out by the creators of the three origin questionnaires - a one-factor solution for the modified C-DAS (MC-DAS) and Attitude Towards Animal-Assisted Therapy Scale (MATAATS),

while the modified CAINTAP can be separated into two factors. These were called "benefits" and "fears". Cronbach´s alpha showed for MC-DAS, MATAATS and the factor "benefits" high results with α > .90, and a Cronbach´s alpha α = .871 for the factor "fears".

4.2. Attitude of German Students

German students showed a more positive attitude towards dogs (*M* = 4.72, *SD* = 1.65) and animal-assisted interventions (*M* = 4.71, *SD* = .98). Furthermore, they rather see benefits (e.g. dogs would distract people from their sorrows; dog-assisted pedagogy would help participants to relax; dog-assisted pedagogy would make the university a happier place) in its use at their university (*M* = 3.46, *SD* = .67) than fears (*M* = 2.92, *SD* = .76) (e.g. dogs would bark at the university; it is possible that the dogs worsen certain respiratory problems; dog allergies would be a problem).

4.3. Influences on Student´s Attitude

Results showed that students' sex had a significant, but small effect on their attitude towards dogs (η^2 = .011), animal-assisted interventions (η^2 = .015) and the benefits they see in its use at their home university (η^2 = .019). Women proved to be a little more in favour of it than men. Only their fears were not affected by their sex (η^2 = .004). In addition, there were differences in students' attitude towards dogs ($F_{(4,502)}$ = 2.535, p < 0.05) and the benefits they see in the use of dog-assisted interventions at their home university ($F_{(4,497)}$ = 2.878, p < 0.05) due to their course of studies (figure 1). Their attitude towards animal-assisted interventions and their fears, however, were not affected by it. Furthermore, their age did not have a significant influence on students' attitudes and interest (*p* > .05).
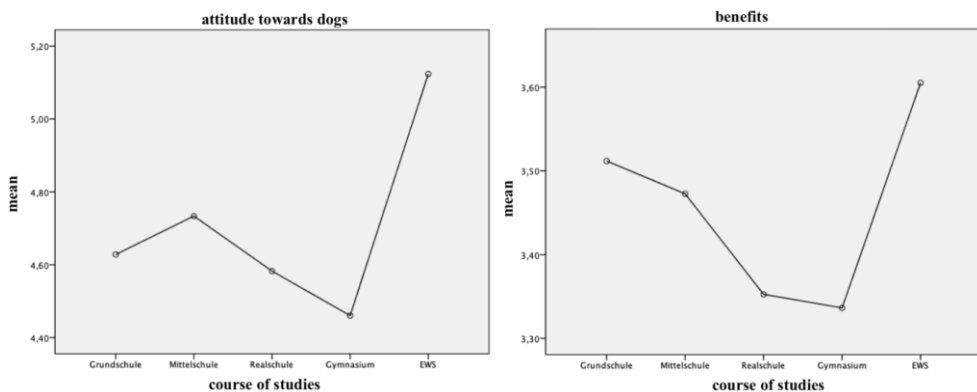

Figure 1. Differences in students' attitude due to their course of studies.

5. Discussion

The aim of this study was to assess German students' attitude to and interest in dog-assisted interventions. The holistic effect animals have on human beings in a diverse assortment of settings has been documented in a wide range of research (e.g. Halm, 2008; Kaminski, Pellino & Wish, 2002) and is one reason for its current use in pedagogical, psychological and therapeutic interventions. Due to the increasing need for counseling service of college and university students and to address their concerns, animal-assisted interventions could be used. As dogs can provide social and emotional support, dog-assisted interventions hold potential to strengthen students' mental health.

The findings of this study show that German students have a slightly positive attitude towards dogs, animal-assisted interventions and interest in its use at the university. They see more benefits in its use than fears. Consequently, the implementation of dog-assisted interventions could be profitable for German universities. Nonetheless, students' fears about its use need to be noticed and preventive measures have to be taken. In addition, students' course of studies and sex have proven to be predictors. Female students and students of educational science showed to have a more positive attitude towards and interest in its use. Furthermore, the questionnaire showed high quality with a Cronbach's alpha α = .936. This result supports the use of this questionnaire to gain information about students' attitude to and interest in dog-assisted interventions at their home university.

6. Limitations and Future Directions

Despite the best of intentions, this study was not without limitations. The majority of the participants were female, the courses of studies were not equally distributed and limited to courses in the liberal arts. Future research should investigate a wider range of courses of studies and make sure that the sample is equally distributed. Furthermore, it should be tested, if the number of items can be reduced, as the survey still is a little time-consuming.

7. Conclusion

As institutions of higher education need to look for innovative ways to support the social and emotional wellbeing of their students, dog-assisted interventions are gaining popularity. Nonetheless, German universities have not yet implemented them. This might be due to the uncertainty if students are actually interested in them. The created questionnaire could provide information about students' attitude towards and interest in dog-assisted interventions at their home university. It consists of 66 items and has proven to be applicable to measure students' attitude towards and interest in dog-assisted interventions.

In addition, the results of this study have shown that German students have a slightly positive attitude towards and interest in dog-assisted interventions at their home university.

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Taking students outside the classrooms. Location-based mobile games in education

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Abstract

The contribution aims at corroborating location-based mobile games as models for the integration of digital technologies in the educational field. They demonstrated to be valid alternatives to formal education in the applied research project: Play Design!, which addressed to high school students, interested in design-related matters, and intends to valorise the Italian design culture, transforming Milan into the stage of a double-sided story. Design is here highlighted both as a cultural heritage and a discipline, inducing the development of two different games sharing a common didactic aim: D.Hunt and D.Learn. The first one is a mobile treasure hunt illustrating the excellences of the creative production of the country, and the renowned protagonists and places of Italy- and Milan-based design: a cultural background to be preserved and valorised. The second one, instead, is a role-play, cooperative and competitive game which depicts the city as a hub for schools and universities, where design is considered a subject for didactic courses, a combination of theories and practices to be transmitted and implemented. Then, the two mobile, location-based serious games exploit this copious and multifaceted material for evident learning purposes, joining the examples of informal education to increasingly follow in future technology developments.

Keywords: Location-based mobile games; informal learning; serious games; technology in education; situated experience.

1. LBMGs as models for integrating digital technology in education

Digital technologies have been spreading more and more pervasively in our current society, at the extent that, since a few years, they penetrated in schools with MOOCs (Massive Open Online Courses), IWBs (Interactive Whiteboards), several educational apps and, currently, AI is gaining ground with software like Gradescope or IBM Watson Education. Yet, in the field of education, since 1980's, AI has been mostly investigated in a knowledge-based approach (Tuomi, 2018, p. 27), and students considered *little pitchers to be filled with facts*, in Dickens's words (1854, p. 5). According to some studies, machines can even substitute teachers in their mundane tasks: revising, grading and even providing notions for students to learn, in addition to supporting them as ITSs (Intelligent Tutoring Systems), and reaching a universal range of different users (Nafea, 2018; Tuomi, 2018). What emerges, though, is a step backwards from a UX point of view and computers seem to have come back to a private relationship with humans, isolating them as it happened in the early era of videogames consoles. Probably, the application of AI systems to education should take in consideration the development of serious digital games as a model. Whether they are a consolidated but not widely diffused approach in education, location-based mobile games (LBMGs henceforth), for instance, go beyond the behaviourist and cognitivist generations of games, laying in pedagogical, experiential and situated learning paradigms (Ulicsak & Wright, 2010). Then, the emphasis is moved from factual education to the improvement of soft skills, which are much needed in a society where automation may overcome many working positions. Collaborative, social and situated dimensions become pivotal in LBMGs, allowing meaning-making through cooperation, coordination and cocreation (McGonigal, 2011), but also in relation to their physical context. This also responds to a contemporary emergency: young students are constantly influenced by rapid digital information and social connections. The challenge is to motivate them to actively participate in an educational experience that fulfils their expectations, proposing them something compelling an enjoyable, fun and cool (Anastasiadis, Lampropoulo, & Siaka, 2018; Read, 2015). To this end, mobile technology has already proved its efficacy, being the protagonist of a new common cultural practice (Mariani, 2014), that brought games and, then, learning in real-world contexts, matching interactive engagement with serious learning (Prensky, 2001), in contact with authentic environments (Huizenga, Admiraal, Akkerman, & Dam, 2009). Digital game-based learning fosters not only game-related skills, but players get acknowledged about specific topics – according to the subject of the game – (Gee, 2003, 2004), and may be influenced in their real life behaviour through active engagement and situated learning (Lave & Wenger, 1991). Taking learning out of classrooms and formal education, thanks to informal and playful activities, thus demonstrates the effectivity of situatedness in physical spaces, where already present and digitally overlaid contents hybridize in a more meaningful world (Klopfer, 2008; Klopfer,

Squire, & Jenkins, 2002), and where social, authentic, open-ended, intrinsically motivating and filled with feedback educating experiences (Klopfer, 2008) may take place. Yet not technology, but its purposes and the entire system in which it is employed are relevant in fostering learning, especially when related to a project of cultural heritage.

In the following dissertation, a case study is presented as an example of LBMGs supporting educational purposes through a wise calibration of informal, playful and engaging experiences.

2. The design of LBMGs as educational tools

To valorise the design culture of Milan, in the *Play Design!* project, the city acquires new values as a rich playground, full of meaningful contents that, at the same time, highlight the glorious traces of past design interventions and the current approaches of design schools and universities. Though, in spite of this duality of possible communication – resulting into two different mobile games – the target users are common to both the experiences. In fact, they have been developed to attract and inform high school students interested in the field of design. This is the reason why the Politecnico di Milano Open Day, where the school presented its undergraduate offers to students perfectly matching the target, has been detected as a positive occasion for the promotion of the project, *D.Hunt* in particular. While, the launch of *D.Learn* required precise conditions and necessitated a further step of registration and consent, therefore bringing to a direct contact with local high schools. Then a specific event followed, as it will be explicated later on.

To better engage the young public and properly communicate the unique identity of the project, both games share a common contemporary graphic language, which is based on bright colour variations and a simplified geometric style. Also the logo is playful and captivating: it is inspired by Munari's Zizì Monkey (protagonist of *D.Hunt*), which is differently portrayed for the two games, and in the promotional tools (postcards, pins, website, digital fabricated rewarding medals, etc.). The customisation of the games' user interface, instead, is limited, because the development of the mobile learning experiences has been realized with the support of a bespoke commercial platform. This choice has been due to limited resources and to the aim of the project, that was not focused on the generation of a new app but on the testing of LBMGs as educating tools capable of communicating the design traces across the city. Additionally, it allowed an optimisation of the iterative process employed to verify the functionality of the games. Before the launch, they were tested several times: firstly, by the research team, and subsequently involving a sample of final users. Actually, most of the test and correction phase was focused on the contents and on the user experience, because basic development problems were avoided

using the off-the-shelf platform, limiting the errors to simple bugs and mistakes in the location of the Points of Interest (PoIs henceforth) and typos.

Apart from the above-mentioned points of contact, related to a coordinated organization of the project, this had to respond to different purposes. For that reason, narrative, game tools and mechanics, and, consequently, the methods of assessment of the experiences were differentiated.

2.1. D.Hunt

Targeting high-school students who are curious about design and who want to enjoy an engaging activity, *D.Hunt* aims at fostering the recognition of design traces in Milan. Here, renowned industrial products, designers and brands, iconically representing the Italian design in the world, are intended as a precious cultural heritage to be discovered. That is why the game genre of *treasure hunt* seemed to be the most effective approach, on which to build the narrative providing information and contextualization to the subject.

To encourage involvement and active participation in a single player experience, the story begins with a mystery: the famous Zizì monkey has been kidnapped and the player is the detective designer appointed to find it, following its traces. Zizì monkey fulfils the double task of narrative device and Cicero, guiding the players through the streets of Milan to make them discover institutions, showrooms, and important public places of the history of Italian and Milanese design. The pet toy is actually the virtual protagonist of the treasure hunt and it highly marks the narrative register. In fact, the monkey directly interacts with the player asking questions and giving clues, not only through the visual interface of the app, but additionally by means of audio tracks that simulate a radio broadcast providing design-related notions. During the speaker's narration, in fact, Zizì intrudes in the transmission to suggest the next move. This tool contributes, once again, to link the different locations in terms of plot and physical path, to foster learning by a curious and informal channel, and to lighten the entire experience, making it more enjoyable. All of this results in a friendly and informal tone throughout the entire game, from the description of the rules, to the narrative and the questions.

The game develops completely in the intertwinement of the digital mobile experience and physical relevant spaces. It starts at the Bruno Munari Association (accordingly to the protagonist of the story) as the first of fourteen locations in downtown Milan. There, thanks to the GPS localization of the player's smartphone, the app provides the first hint, opening a path of investigation through clues and questions regarding the history of Italian design, icons (products, interiors or graphics) or designers strongly related to the places where they are triggered. So, the player has to figure out the correct answers to proceed in his mission and reach the following location, activating a process of informal learning. Each question has multiple answers and one single error is allowed, causing, as a result, the appearance of

an additional hint. The difficulty level of the game is medium-low to meet the knowledge of a young audience which is only interested in design related matters but not strictly specialized: detailed descriptions or images are provided, facilitating the player's correct inferring. When the player manages to solve the enigma, at the end of the treasure hunt, each solved task is assigned with a score based on the number of correct answers provided and the performance is accordingly evaluated as: a Sherlock of investigations, a good detective, a promising apprentice or an inexperienced beginner.

Regarding the assessment of the experience, in this case, it was difficult to have significant and first-hand feedbacks, as the game can be easily played autonomously and without supervision. The only meter of evaluation derived from an up to five stars rating and simple digital comments.

2.2. D.Learn

Otherwise, *D.Learn* purpose is to engage students ready to undertake a higher-level education in design and, therefore, who are more interested in the didactic aspects of the discipline, such as its complexity, branches, interrelations and modalities of development, mostly characterized by teamwork. Therefore, a *role-play* competitive game better suits these necessities. *D.Learn* involves four teams (representing the different courses of Politecnico di Milano: product, interior, communication and fashion design) confronting each other and composed by three members. This kind of experience requires the players to identify in a character and to collaborate with others to complete the game, acting accordingly to both their role and their team's specialization as a metaphor of a designer's daily work. A participant can play as: the *navigator*, who is provided with a smartphone and has to correctly locate the PoIs, control the position of the other teams and generally interact with the device; the *strategist* with a physical map of Milan city centre, who needs to plan the team's activities taking in considerations the scores and locations of the questions; and the *dealer*, who is equipped with a card deck with useful information for the resolution of the game and its trials. Each team has to solve ten quizzes with different levels of complexity, which are divided into: seven related to the team's specialized path (product, interior, communication or fashion design) and three concerning other design practice roles. Differently from *D.Hunt*, *D.Learn* needs an organizational support to regulate the formation of the teams, to provide the physical game kit, and to assure that every game session begins simultaneously, lasting about one and a half hour.

The starting point is Piazza del Duomo, then the game spreads across the city centre, according to each team's planning, through always visible PoIs: museums, showrooms, hotels, graphics, urban indoor and outdoor with clear meanings in relation to the design topic. It is patent that this game is more focused on challenging than on narrative features, and the educational goal is developed through a series of trials and thoroughly stimulated

by the competition among the teams. In order to prevail, it is necessary to reach the highest score. Points and skills can be obtained along the way by correctly answering questions (always with the aid of hints on the cards); by visiting rewarding places, where the players acquire information on important brands, products, interiors, designers, graphics, or simple curiosities; or by stealing points to the opponents. In fact, team clashes are possible inside the gaming area, and the team with a highest score steals points from the other. That is why the players are more and more encouraged to reach the largest number of locations and give the right answers, actually seriously learning in an informal context Finally, the game session ends at Piazza dei Mercanti, where a final riddle has to be solved: the decryption of a code, for which the cards and the paper map are fundamental. The evaluation of this experience from the research team has been far easier than the previous one. As it required from six to twelve players to organize one game session and it needed control to start at the same time, a more direct contact with the players was inevitable. The researchers supervised the teams to record the experience and to guarantee the safety of the players, since most of them were underage. In addition, post-game interviews were organized.

3. Results

As already mentioned, the two games have been investigated in different ways, hence leading to different kinds of results. If *D.Hunt* evaluation is based on about one hundred one to five stars and tweet-like feedbacks, which could be quantitatively relevant but not completely reliable for drawing inferences; *D.Learn*, instead, counts on less played sessions, valuable from a qualitative perspective as stemmed from informal interviews and direct observation. Thus, only the latter will be discussed.

Primarily, the principle aims of the research – related to informal learning and the promotion of Milan design-related matters among interested high-school students – have been assessed. In fact, unknown design notions attracted the attention and were reported of increasing the knowledge of the participants, both because the system was designed to accompany students in a structured process of learning and comprehension, giving them the opportunity to answer the questions correctly and, mostly, because of the active involvement triggered by the game mechanics and real time, physically experienced collaboration and competition. As direct observation proved, players were so motivated that they carried on with the game despite the playground was considerably wide. Additionally, they expressed appreciation on the contextuality of the game: information provided close to the place it referred to, thanks to location-based dynamics, allowed a more meaningful learning and an active exploration of the city, bringing players to notice details they had never seen before and to build new personal geographies, overlaying the actual city with game contents (Montola, Stenros, & Waern, 2009). Another important feature of *D.Learn* is the integration of digital contents with physical tools, to be used together in order to

succeed in the game. This represented a further incentive for involvement, putting the digital and physical realities in contact, and, also, for social engagement. As a matter of fact, the digital device alone nurtures a self-referential focus, while physicality fosters an extroverted attitude, encompassing contextuality and social sharing (Petrelli et al., 2013; Spallazzo & Mariani, 2018). In this specific case, the physical facilitators and the designed role-play mechanics forced the players to exchange information, skills and resources, inducing a discussion on the topics and, therefore, the building of a shared understanding and learning process, also reinforcing the team spirit. Thus, despite the limitations in the evaluation of the two games, it is possible to state that the project achieved good results in respect to the defined aims, leading to the valorisation and contextualisation of Italian Design throughout Milan and highlighting how culture can be diffused in an informal and playful way.

4. Discussion

The illustrated project has opened didactic experimentations that have been discussed in other papers. Though, it still has not fully exploited its significance. In fact, it gathers aspects that contemporary technological implementations in education should reckon. First, modern education should get passed conventional modalities to respond to the necessities of a rapidly changing society heading to automation. In this sense, informal game-based learning represents a valid alternative to a data-based education. It involves engaging experiences and narratives that encourage learners' motivation; if properly employed, exploiting different sources of information – physical spaces and tools, digital contents and the player's mind (De Souza e Silva, 2006; De Souza E Silva & Sheller, 2015) –, it can enhance sociality, through collaboration or competition; and thanks to mobile technologies, situatedness and contextuality can be added values. By the way, technological devices alone risk to be exclusively self-referenced, isolating the users in a digital dimension, while the integration of real-life components (social or environmental) always has to be taken in consideration for actual engagement and learning.

In conclusion, the presented projects are intended to stimulate further reflections on future applications of spreading technologies in education, taking advantage of past experience.

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Entrustable Professional Activities in Residency Programs – planning and scheduling issues

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Abstract

Residency programs allow residents, i.e., graduate physicians, to qualify for being a specialist in one of the medical disciplines. Their educational programme is strongly focusing on competencies and skills, but will incur a major change in the near future in order to introduce Entrustable Professional Activities (EPA's). EPA's focus on actual physician tasks and are assessed by supervisors in the clinic. The trust levels indicate whether trainees are ready for the next milestone, such as unsupervised practice, based on assessment of performance of those activities. EPA's have not only effect on the internships and the assessment process, but also impact the planning and scheduling of the educational programmes, internships, patient care services, and co-operation between regional hospitals. This study examines the effect on the planning and scheduling process and proposes a framework for planning and scheduling in order to facilitate the organization of this type of educational programs. The main improvements have to be found in an improved regional coordination between the hospitals, a more leading role for the educational programme directors, and more intelligent planning and scheduling.

Keywords: Educational organization, Planning and Scheduling; Learning for employment; Skill assessment.

1. Introduction

Residency programs allow residents, i.e. graduate physicians, to qualify for being a specialist in one of the medical disciplines. A typical residency program lasts for around 4-6 years. It consists of internships and educational activities, such as workshops, trainings, et cetera. The internships allow residents to develop specific skills in practical settings under supervision of an attending physician. Residents learn by training on the job while at the same time contributing to the provision of care services. However, they are also involved in the provision of regular patient care services in the hospital during night shifts, weekends, et cetera, even though these activities do not serve a direct purpose for the educational program.

A major change in program setup and delivery is due to the adoption of a recent educational innovation in the field of competence–based learning and skills development: the use of Entrustable Professional Activities (EPA's) (Hauer et al., 2013; ten Cate, 2013) as the basis for assessment, rather than a time- or operation-based assessment. By describing the programme outcomes in terms of EPA's that should be performed at a predefined trust level, residency programs allow for more flexibility in terms of length of internship and reduce the inherent complexity of assessing competences. The change towards adopting EPA's has huge impact on many processes and consequences for professional standards the discipline has to adhere to, as has been described in literature (Englander & Carraccio, 2014). However, the planning and scheduling problem that arises when implementing this educational innovation has not yet received attention in literature. As this innovation allows for different paces amongst the residents in the educational programme, planning and scheduling of their activities and regular care services cannot remain unchanged. This paper will focus on the required changes in planning and scheduling of residents' activities for the on-the-job training and patient care services they provide in hospitals. It aims to develop a framework for planning and scheduling that supports the change towards program delivery using EPA's.

2. Planning and scheduling of residents' activities

Planning and scheduling of residents' activities consider the time-based ordering of residents' activities within the program period. The planning and scheduling of residents' activities is considered to be complex and time consuming (Cohn, Root, Kymissis, Esses, & Westmoreland, 2009; Ernst, Jiang, Krishnamoorthy, & Sier, 2004; Güler, Idin, & Yilmaz Güler, 2013). Outcomes of the planning and scheduling activities, i.e., programs, rosters, and schedules are often criticized by the various stakeholders, especially residents, educators, and the department management. Issues like the fragmentation of the educational schemes following from an integration of a residents' educational and remainder activities, the imbalance of supply and demand for educators, and the balancing of residents' and management interests in scheduling non-educational activities are frequently put forward.

There is a strong feeling that these issues hurt the effectiveness of the residence program in terms of educational outcomes.

Moreover, ongoing specialization of hospitals towards provision of specific care services implies that internships required for residents' qualification can no longer be offered by a single hospital. This emphasizes the need for regional coordination of residents' activities among district hospitals and academic hospitals. The departments of these hospitals that are involved in an educational program have to co-ordinate their involvement. However, it is not just the planning and scheduling of individual residents that needs to be resolved, but also the interest of these departments for their role in the educational programs of the residents. Moreover, the implementation of the concept of personalized learning, i.e., tailoring the program to individual resident's qualities and progress, work-life balance, and part-time employment, strongly increases scheduling detail.

One of the more recent factors that impacts planning and scheduling strongly is the measurement of learning outcomes and its impact on the resource planning in hospitals. We observe a tendency to measure outcomes of educational programme for residents, e.g., in the US, Australia, The Netherlands (Englander & Carraccio, 2014), using Entrustable Professional Activities (EPA's). EPA's reflect specific competencies, skills, knowledge, and attitudes required for a professional task with a recognizable output. They focus on actual physician tasks and can be assessed by experts. The trust levels indicate whether trainees are ready for the next milestone, such as unsupervised practice, based on assessment of performance of those activities. Typically, five or more milestones (i.e., levels) of these tasks are distinguished and minimum performance levels for trainees may differ. EPA's introduce additional planning complexity due to the inherent uncertainty on when new levels are being acquired, which has an impact on the availability requirements of residents and their supervisors. At the other hand, planning and scheduling may become easier as well due to the possibilities that the systematic monitoring of skills available among the physicians and residents offers. Nevertheless, the change towards EPA's has consequences for planning and scheduling and raises several issues. This study explores these issues by using several data sources and qualitative research methods that will be discussed in the next section.

3. Data sources and research methodology

Each educational programme that uses or plans to use EPA's in programme delivery and assessment needs to describe the programme outcomes and assessment process. We selected a Dutch Residency programme on radiology that has described their programme in terms of EPA's. Moreover, the programme director has been interviewed in order to better understand the choices made when redesigning the programme.

Next, interviews with several residents have been issued. The main question during these interviews related to the planning and scheduling issues when a change towards EPA's and more personalized learning would be facilitated. This resulted in an inventory of issues, requests, and bottlenecks that they encountered.

Finally, we investigated amongst schedulers how they perceived the problems (current and future). Note that the scheduler could be one of the residents, a department secretary, or even a supervisor, depending on the size, organization, and complexity of the department and the educational programme.

For developing a new framework for planning and scheduling, we used design methodology.

4. Results

4.1. Entrustable Professional Activities in the programme of Radiology

The analysis of the educational programme of Radiology revealed that it entails 120 EPA's, divided amongst eight themes that are all necessary for an all-round radiologist. For each theme a minimum length of the theme-internship is determined, as well as a list that specifies how frequently specific professional activities on average have to be performed, reported and reflected upon as part of the educational programme. Moreover, each radiologist may select up to two themes for a differentiation. Within the differentiation, a higher level of some EPA's need to be achieved, accompanied with longer internships within these themes. This is made explicit in the programme description. Once a resident starts in a new theme at EPA level 1 (*not allowed to perform, not even under supervision*), a pre-test is taken. When passed, the resident is allowed to accompany an trained educator and observe how the activities are done. After achieving the second EPA level (*allowed to perform, but under direct supervision*) the resident is allowed to accomplish the task under direct supervision. The supervisor will take the lead in providing feedback at these two EPA levels and is present during the whole task. The third EPA level (*allowed to perform the set of activities with indirect supervision*) is the next trust level a resident can achieve. From this EPA level onwards, the initiative to receive feedback is with the resident itself. The supervisor does not have to be at the same location, but has to be available for feedback. For highly complex and less frequent tasks, this level may be the highest to achieve for a resident that will not specialize in this theme. However, for frequent and less complex tasks, EPA level 4 is the standard for all residents: *allowed to perform unsupervised*. Residents that specialize in a theme have to achieve even EPA level 5 for these frequent tasks: *allowed to supervise.*

4.2. Residents perception of scheduling issues

The residents indicate that due to their personal circumstances (i.e. family planning), most of them prefer to work part time (80%), which in practice means that their number of working

and studying hours per week are similar to full time jobs outside the clinic, as 38 hours per week is the normal number of working hours in The Netherlands for full time employees. Previously (i.e. a decade ago), the majority of the residents worked full time. This has consequences for planning of internships and the length of an internship, as it affects the build up of expertise and frequency of practicing some acitivities. However, schedulers do not always take this into account. Moreover, they are sometimes involved in all kinds of unscheduled activities, such as making their own rosters, preparing meetings, administration, and organizing activities, which would normally have been accomplished by support staff from the department or hospital. Due to budget cuts, this kind of tasks have to be done by the residents themselves, which takes a lot of time.

Finally, the main stressor for residents is the uncertainty with respect to their programme as well as regular care services they have to provide. To proceed to another level of an EPA, a minimum of two supervisors need to sign off and approve that the resident is entrusted to a higher level of autonomy. This is not just based on number of activities that have been performed and reflected upon, but involves an overall assessment. This increases uncertainty for the resident. With respect to the regular patient care services, it is mainly the uncertainty of additional care services they have to fulfill, due to unavailability of other staff members. This uncertainty causes a lot of stress due to the organization of private life (child caretaking for example).

4.3. Schedulers and their perceptions on the residents' scheduling problem

The schedulers report that the problem consists of several layers. They receive inputs from the head of the department on the internships that have been planned for the next months, as well as the available capacity of the regular staff of the department. Next they determine a schedule with a horizon of three months that details the who, when and where of the planned availability of the residents, supervisory staff, and other staff in this department of the hospital. Based on the three-month plan, detailed short term plans are extracted in which attention is given to both the educational activities and the total care delivery, also in case no direct supervision is available (weekends, night shifts, et cetera).

The main problem the schedulers face is the amount of rework in the scheduling process. They receive some information too late, changes are required while they had not been informed, et cetera. The schedules are rather detailed but not accurate. The second problem is the lack of anticipation capability on capacity shortages. As schedulers, they are not able to fill these capacity shortages, so they deliver incomplete schedules. Finally, changes to another EPA level causes major changes in the capacity and flexibility of staff in the department, but are difficult to include in the schedules due to the aggregation level of these schedules. For the lower EPA levels, tow scheduling (trainee and trainer) has to be applied,

while at higher EPA levels, single skilled operator scheduling would be possible (Hadjaissa, Ameur, Ait cheikh, & Essounbouli, 2016).

5. Framework, conclusion and future research

Based on the findings of the various stakeholders, we have developed a new framework for planning and scheduling of residency programs. The framework depicts some major changes in the way plans and (more detailed) schedules are to be produced, what actors will have to take the lead in what stage of plan development, and what will be the main decisions to take. It is based on lean planning principles as described in literature (Riezebos, 2018). The main changes we propose are:

1. Improved regional coordination in order to enable personalization and speed-up of residency programs.
2. Program coordinator in the lead: better planning of EPA's per resident, enabling residents to achieve the intended learning outcomes and competencies per EPA level.
3. Intelligent support of planning and scheduling: use algorithms to reduce changes in the timing aspect of planning decisions (when to provide service or be involved in educational activities), while allowing for changes in the what and where of these decisions (what activities in which department). Examples of intelligent support can be found in e.g., (De Bruecker, Van Den Bergh, Beliën, & Demeulemeester, 2015; Erhard, Schoenfelder, Fügener, & Brunner, 2018; Stolletz & Brunner, 2012; Topaloglu, 2006; Van Den Bergh, Beliën, De Bruecker, Demeulemeester, & De Boeck, 2013; White, Nano, Nguyen-Ngoc, & White, 2007).

The framework that we propose is depicted in Figure 1.

At the left hand side of the framework, we have allocated the central role of program coordinator and regional coordination between hospitals where the internships can be performed. Not all themes can be performed at every hospital in the region. And for complex care, the expertise and possibility to develop skills might only be available in the academic hospital. This requires coordination in order to facilitate the individual preferences for learning of the residents as well as the capacity of educators in the various hospitals. The result will be a grouping of residents per location and per theme.

The middle part of the framework depicts the planning and scheduling activities within departments where one or more themes can be trained. Here, EPA planning will be the basis for developing capacity plans and schedules. Task allocation (i.e., what EPA to accomplish when and by whom) and a detailed schedule of the timing a resident has to provide care services during the internship and regular care of the department (night and weekend shifts)

has to be accomplished and produced. Based on these plans, a more detailed analysis of required capacity of the regular staff can be made.

At the right hand side of the framework, the residents themselves will have to decide who will take what care services at the specified time slots. They will take their own progress in terms of EPA's into account when selecting the location and activities in the department for the specific time slot. The main uncertainty with respect to the timing of their work hours has been addressed at an earlier moment, but the decision what activities to perform can be postponed. Next, their decisions can be used as input for the physicians that co-operate with the residents in the patient care operations, as they might be able to support the residents in making the most of their regular care services in terms of building expertise, challenging their learning process, and finding evidence from new cases.
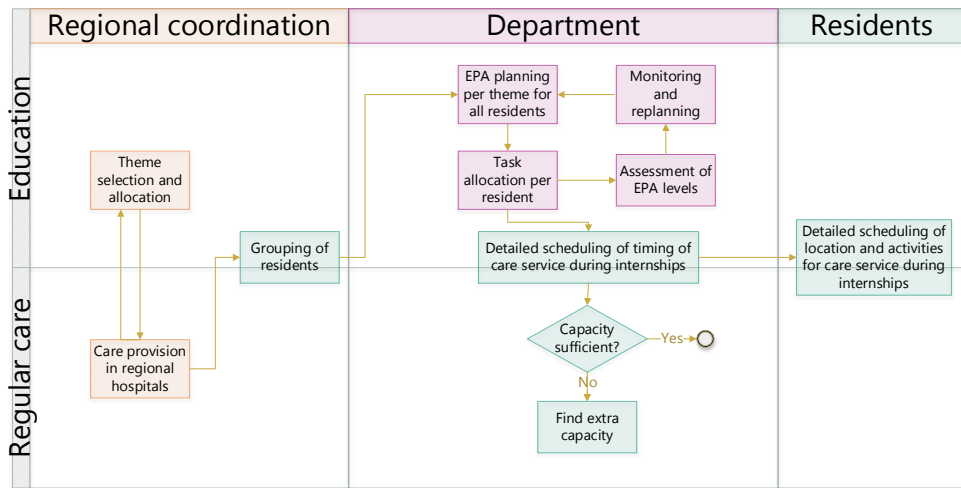

Figure 1. Framework for planning and scheduling of residency programs and activities

Based on this new framework, people can be trained and algorithms can be developed to support the decision making at the various stages of plan development.

We conclude that the problem of planning and scheduling of resident activities in programs that have implemented EPA's needs a change in the way hospitals plan the activities of residents. Within a theme, some 8-10 EPA's might be formulated and each EPA distinguishes five levels at which the activity is allowed to be performed by the resident. Each level corresponds with requirements on the availability of supervisors that are able (i.e., allowed) to provide feedback and assess. Not every level can be achieved at every hospital in the region, so the resulting planning problem is complex and needs to be supported by a systematic process, including training and algorithmic support.

The main discussion point is whether hospitals realise that a fundamental change in the assessment procedure towards EPA's will have a major impact on the way they plan and schedule their educational programmes and their care service operations, the capacity problems that will arise, and the responsibility referents will take for their own education.

Acknowledgements

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Doing Math Modelling Outdoors- A Special Math Class Activity designed with MathCityMap

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Abstract

The use of smartphones in classrooms is unfortunately due to the restriction legislated by administrations not very popular. With the MathCityMap project (MCM) we show one possibility to use the own mobile device in a substancial and authentic learning environment. MathCityMap combine the well known math trail idea with the current technological possibilities of mobile devices. The MathCityMap is a two component system. The first component is a webportal (www.mathcitymap.eu) which served as a open access database for authentic math problems in the environment. The other component, the MCM-App, shows on a map where in the environment the problems are hidden. Additional it provides hints, feedback and a sample solution. To solve such an authentic MCM problem you need mathematical modelling competencies. We show with the help of one example in which way the students work with the tasks and how the system deal with different solution which occurs by solving a modelling task.

Keywords: Mobile phone; App; Mathematics; modelling; outdoor; real world.

1. Introduction

Mathematical modelling, in the NCTM Standards known as connections, is not easy to teach. First there is a lack of good beginner modelling tasks even for undergraduates students and second a lot of so called modelling tasks are not authentic and not realistic (Vos 2011). With the MathCityMap-Project (MCM-Project, www.mathcitymap.eu) we like to motivate students to solve real world tasks by using expedient mathematical modelling ideas outside the classroom. The MCM-Project (see chapter 3) is based on the math trail idea introduced in Melbourne, Australia in 1984 (Blane &Clarke, 1984). To solve a typical task which is provided by the MCM-app (e,g,. to calculate the mass of a rock) you need to transfer the real model into a mathematical model. The MCM-app provide hints, checks the answer of the user and gives a direct feedback.

2. Theoretical Background

2.1. Math trail

A math trail is a set of mathematical tasks or questions that are bound to objects from the real world. Usually they are located in walking distance. A math trail guide contains a map that displays interesting locations and descriptions of different tasks to discover mathematics in the environment. Shoaf, Pollak & Schneider (2004) saw a potential in math trails to popularize mathematics since everyone (e.g. families) can walk them, the participants' work cooperatively and thus experiencing mathematics in a non-threatening environment. In addition, walking a math trail is a good way to make experiences with the perceptual motor system, which is the base of all mathematical concepts (Wittmann et al, 2012).

2.2. Mobile technologies, motivation and hints

The use of mobile technologies has significantly increased during the last few years. Internet usage via mobile phone, for example in Germany, has increased so much that 60% of all internet connentions in 2017 were provided by mobile phone (Statistisches Bundesamt, 2017). If one considers that 99% of the group of the 16- to 24-year-old Germans uses the internet, it is evident which important role the internet and especially mobile internet play in the students everyday life. Moreover, it shows that the percentage of students who use mobile technologies as mobile internet has greatly increased. Consequently, the appropriate technique for the MCM-project is available for many students now.

The use of mobile technologies to learn at any time and at any location is known as "mobile learning" (m-learning). Considering the definition of O'Malley et al. (O'Malley, Vavoula, Glew, Taylor, Sharples, & Lefrere, 2003): "Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner

takes advantage of the learning opportunities offered by mobile technologies." One notices that this definition does not exactly match with the Idea of MCM, because the location where you have to solve the task is predetermined. Therefore, it is a process of "mobile learning at predetermined locations".

In the MCM-project mathematics should be discovered and experienced using math problems, which are based on real examples of daily life situations and have to be done on the spot. For many students this is an entirely new perspective on their environment. The discrepancy between the previous and the new perception produces curiosity, which can be defined as a prime example for intrinsic motivation (McLean, 2003). Intrinsic motivation also arises because of the fact that mathematic education takes place in an out-of-school activity. Furthermore new, and for students interesting, technologies are used which is a discrepancy to their previous perception, too.

The concept of stepped hints is another important component of the MCM-Project. According to Friedrich & Mandl (1992) learning hints generally fulfil the following functions: to paraphrase, to focus, to elaborate sub-goals, to activate prior knowledge, to visualize. However, it is not excluded that single learning hints can have several functions. The main goal of hints is to give students the opportunity to treat and solve math problems independently. Even if they fail at their first solution process, they can get a result with the help of the learning aids. Studies (Franke-Braun, Schmidt-Weigand, Stäudel, & Wodzinski, 2008) are shown that stepped hints have a positive impact on learning performance, learning experience and communication.

2.3. Modelling

Referring to the modelling cycle according to Blum and Leiss (2005) (Fig.1) we can see that there are several step to go before a problem solver succeed. In total there are seven steps. "Mathematical modelling competency" has been defined as "the ability to identify relevant questions, variables, relations or assumptions in a given real world situation, to translate these into mathematics and to interpret and validate the solution of the resulting mathematical problem in relation to the given situation, as well as the ability to analyze or compare given models by investigating the assumptions being made, checking properties and scope of a given model etc." (see Blum et al. 2007, p. 12). We know through the research of Boromeo-Ferri (2006) that some of the students do not pass the circle consecutively, but they sometimes jump directly from the real situation to the mathematical model or go forth and back several times between the real world and mathematics world.
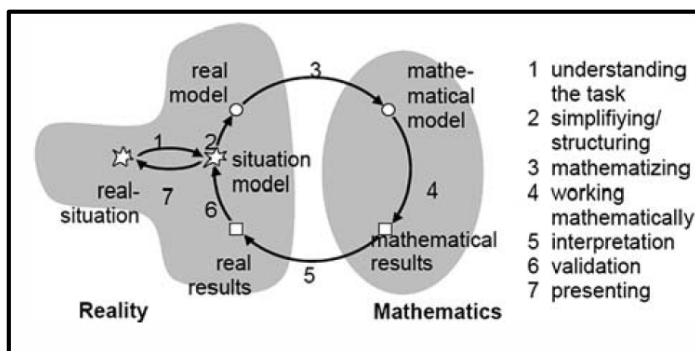
Figure 1. Modelling cycle according to Blum and Leiß(2015).

2.4. Difficulties integrating new technologies into math classes

With new technology in schools, the question has always been, do teachers work with the new tools, how do they use them and so on. Paul Drijvers made a study in 2012 about the factors for successful use of new technology amongst teachers. One of the three important factors is the role of the teacher (Drijvers, Boon & Van Reeuwijk, 2010). A majority of the German teachers report to have not enough time beside their daily tasks at school (Schneider, 2015 p. 20). The time a new tool needs to be set up is an important issue. We will show that MCM simplifies the creation process of designing tasks and trails and make it less time consuming.

3. The MCM Project

Through the combination of the math trail idea (embodiment, outdoor, being active), mobile devices and mathematical modelling, one can describe the idea behind the MCM project.

Figure 2: The filled in data form of a MCM task.

The intention of MCM is to automate many steps in the creation of the math trail guide and to provide a collection of tasks and trails that can be freely used or just viewed to get inspiration for own tasks. Furthermore, it gives users (e.g. groups of students) the possibility to go on a math trail more independently by using mobile devices' GPS functions to find the tasks location. Further, it gives feedback on the users´ answers and provides hints on demand. The core of the MCM project can be divided into two parts: the MCM web portal and the MCM app.

3.1. MCM web portal - www.mathcitymap.eu

At first sight, the web portal is a data base. After a short registration, the user can view the content of the data base which consists of public trails and tasks. It is also possible to create own tasks by providing the necessary data (position, the task itself, the sample solution, the answer as interval, exact value or multiple choice, an image of the object, stepped hints) (see Figure 2). To create a math trail one combines different tasks by clicking. For every math trail, the math trail booklet can be downloaded as PDF or accessed via the MCM-App. It contains all tasks information, a map of the trail and a title page (see Figure 3).
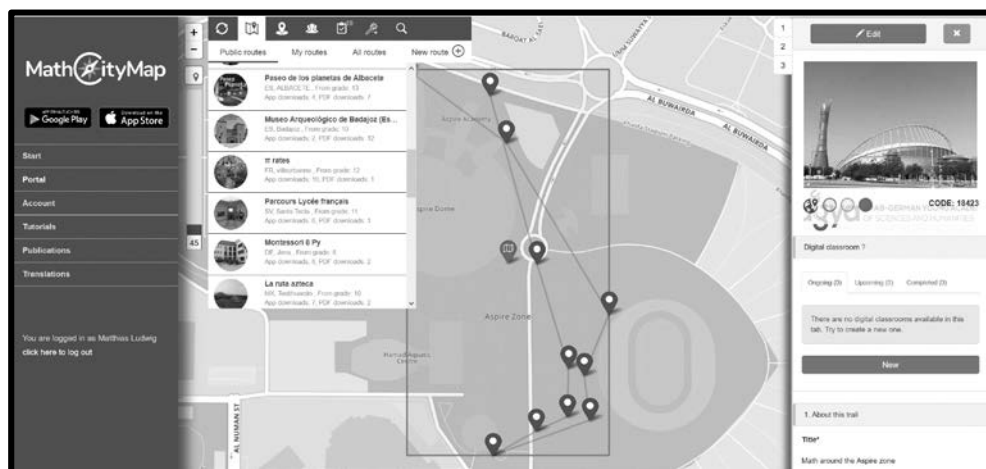
Figure 3: A math trail (polygon) with the all the tasks symbolized by blue pins.

3.2. MCM app for mobile devices

The MCM app allows the user to access math trails created with the web portal. The trail data, such as images and map tiles, can be downloaded to the mobile device. After this procedure, it is possible to use a trail without internet connection. Furthermore, the app offers an open street map overview for orientation purposes, the task itself, a stepped hint system and a feedback on the entered answers. (see Figure 4)
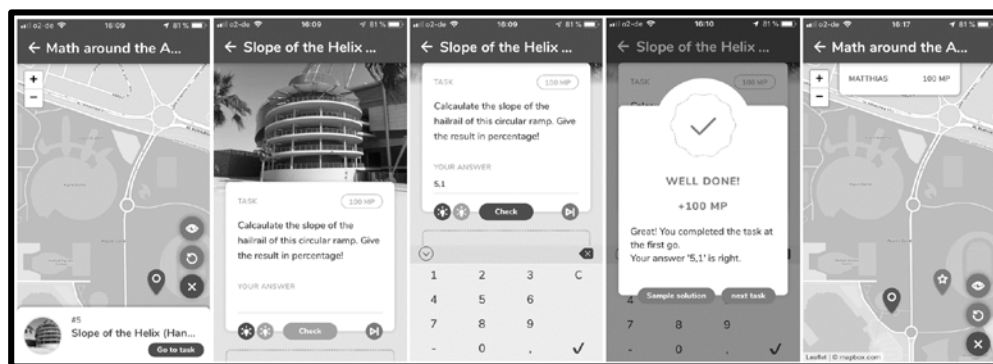
Figure 4: The map with the first task, the task itselfs, the keyboard to type in the solution, the feedback, the green pin shows the solved task and the blue pin show the next task toi solve.

The hint system has the purpose to enable pupils to solve the tasks independently and additionally has a positive impact on learning performance, learning experience and communication (Franke-Braun, Schmidt-Weigand, Stäudel, & Wodzinski, 2008).

4. Modelling and the MCM project

The processing of a MCM task basically requires the complete running through of the modeling cycle, (see Figure 1). Nevertheless, in many MCM tasks, one can recognize a focus on simplifying and mathematicising the real situation, which corresponds to steps 2 and 3 here. Simplifying separates important from unimportant information taken from the real situation. Mathematization (step 3) is followed by the translation of the simplified real situation into mathematical models (step 2) (see Greefrath, Kaiser, Blum & Borromeo Ferri, 2013).

The following task was part of a math trail. The trail was running by 153 9th graders and 52 undergraduates' university teacher students. We divide the students normal into group of three, so we get 51 groups of 9th grades and 17 groups of undergraduates. It was a mixed trail with different tasks about combinatorics, numbers, solid geometry and probability. The task we want to emphasize in this paper was: "Calculate the volume of the flowerpot. Give the result in liters!". In figure 5 on the left you see the task how it appears on the prepared smartphone (1).

After the students run the trail, we collect the phones and the students' notes. The shape of the flowerpot is obviously a truncated cone, but when you not know the formula of the volume of the truncated cone, you have to deal with the situation in other ways. We categorize the students' solutions and found four categories for this task. First category is "task is not solved" this means nothing is written down, or a very fancy solution which you cannot connect to the task itself. The other three categories we show in figure 5 (picture 2-4). Each solution deals with different mathematical models. In each category, the students have to create their own real model and then they mathematize by adding variables they have to measure. They have to think about which data they have to measure. This is really the difference to modelling tasks in the Classroom. The solution (2) in figure 5 use the mean of the small and big diameters of the truncated cone and calculates the volume with a formula of a cylinder ($V = \left(\frac{R+r}{2}\right)^2 \cdot h \cdot \pi$). The solution on the right (3) of figure 5 deal with the volumes of two cylinders corresponding to the small and big diameters of the truncated cone. The result is the mean of both volumes of the cylinders ($V = \frac{R^2+r^2}{2} \cdot h \cdot \pi$). The solution (4) on the bottom of figure 5 appeared when the student knows the formula of the volume of a truncated cone ($V = \frac{R^2+Rr+r^2}{3} \cdot h \cdot \pi$) and uses it. It is very interesting that at the end the results of the students do not differ very much. On one side this is because of the exact measurements and on the other side because the shape of the truncated cone does not differ very much from a cylinder. To give the students feedback on the appropriateness of their models, the MCM App uses solutions intervals. The intervals based on calculation of errors and experiences of the task creator.
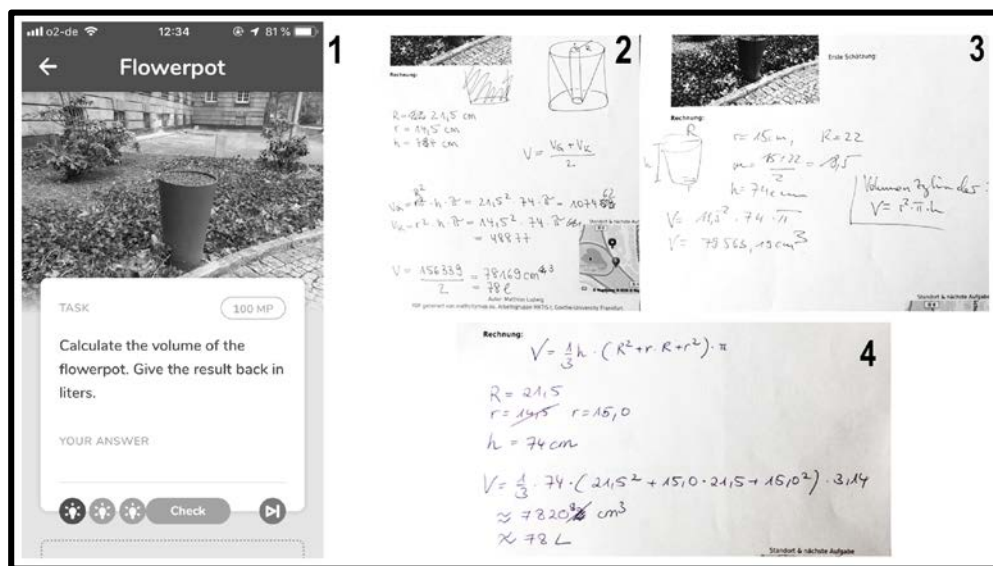
Figure 5: The flowerpot task how it appears in the App (1) and the three student solutions for the flowerpot task

When we look on the numbers of student groups who uses which solution approach we found that 20% of the 9th grades are not able to solve the task in an appropriate way. But approach 2 (mean of the radii, see fig. 5 (3)) is used very often (60%). Some of them use the second approach in another way. They measure the circumference of the truncated cone in the middle of his height and get the mean circumference in once. The third approach (create the mean of a big and small cylinder) is used very seldom.

5. Results and Discussion

The MCM-Community (2000+ users) creates in the last two years more than 900 math trails and more than 5500 tasks with the MCM system. An ordinary trail has about 9 to twelve task. Each task get a number. The students work together in groups of three. Each groups starts on a certain task. When the group finished the task they move clockwise to the task with the next number. In an normal educational context every group uses theirs own prepared smartphone with the MCM-App, which contains all the trail and task information (GPS Coordinates, hints, sample solution) and a paper trail guide which they can use for sketches and written calculation.

In total, we see that doing math on real objects lead the students in a natural way to structure and simplify a task. Then they create a real model, mathematize it by adding variables and do measurements. At the end the students get a feedback from the app and they validate their

solution. Overall we can say the MCM-System helps to teach the beginning of mathematical modelling

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Desafío Programm. An Erasmus rural version for depopulated areas

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Abstract

In remote rural areas, economic and social life exits, although young universitarian don't believe it. Dynamic companies, innovative administrations and creative third sector need talent, the most decisive input, but it is scarce and it is difficult to compete with cities to attract it. Public Universities linked to local communities could match each part, students and employees, facilitating their respective knowledge through summer internships, improving the human and social capital on both sides.

That's the objective of Desafío Programme, the experimental policy which we analyse in this work. It is implemented by the Provincial Council of Zaragoza and its University to do it reducing transaction cost by giving information and offering grants to the students who decide to work and live in very small villages. Thanks to it they obtain a professional experience in which to apply their knowledges, but, more important, they enrich themselves through an exceptional experience, learning by doing and learning by living. We expose the main points of Desafío, the kind of studies required, the type of company and organization, and the relevant costs. In base to the polls and interviews made before and after, we can deduce a very good valuation of students and employers.

Keywords: Learning .by doing; Professional Practice; Out of class learning.

1. Introduction

Numerous rural companies, even in sparsely populated areas, are very dynamic, with an international presence, capable of implementing innovation process, integrated in competitive value chains and very complex clusters (Eder, 2019). Also, local administration of small towns is immersed in processes of new governance, focusing on transparency, efficiency and participation, trying to take advantage from electronic administration (Niehaves *et al.*, 2019). Finally, the third sector manages innovative projects affecting qualitative aspects of well-being, a renewed version of social and individual rights (Saz-Gil *et al.*, 2016). That is, *Smart Growth* is also an important aim of rural development strategies, not only for metropolitan areas, (European Commission, 2018), and needs the main factor that defines it, talent (Florida, 2006).

However, the majority of university students do not know the training possibilities of companies and organizations located at rural areas, and they even have a clear prejudice towards them, in the conviction that these are static societies, lacking in incentives for them (Conejos, 2018). But the most recognized values for well-being and smart development (OECD, 2017), such as participation, social capital, openness, diversity, contact with nature, transversally, transparency, festive atmosphere, are more ubiquitous in small communities, where you become a principal actor in all those spheres, than in most of the urban areas. All that can help to the students to grow up if they experience them in a direct way.

To challenge these dilemmas, so essential for social and territorial sustainability and for a mature learning, the Chair on Depopulation and Creativity[1] planned to combine these two worlds, matching students of the different Degrees at the University of Zaragoza and those companies, social entities and administrations located in sparsely populated areas. It was necessary to induce coincidences between talent (students), promising professional future (employers) and suggestive vital experience (social agents), but reducing their costs of transaction, that is, those of information, meeting and negotiation.

That was the ultimate goal of the *Desafío* Program, to link good students, motivated in their professional learning and longing to increase their personal experiences, with creative activities in different public, private and third sector organizations that fit into their specialization, in order to discover the possibilities so fertile to work and live in a rural community. To do it, we took inspiration in a similar policy done by regional government of Catalonia, Odisseu Program[2].

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[1] http://catedradespoblaciondpz.unizar.es/

[2] http://www.odisseujove.cat/ We thank very much de generous and efficient collaboration of Gemma Estany, Project Manager of ARCA (Associació d'Inicitavies Rurals de Catalunya) and responsible for Odisseu Program.

For the success of *Desafío*, it has been crucial to be helped by Universa, a specific service of the University of Zaragoza with a long experience in labor insertion of students in the social and entrepreneurial network of Aragon. His accumulated know-how and his involvement in all the phases of the project, previous and post, is another basic point that allowed us to move forward in the proposal.

Although the differences with the Erasmus program are notable, since the central question in *Desafío* is not the validation of subjects, so the *canonic* academic sphere remains in the background, they do agree that there is an important life experience for the student in both cases. An experimental way of learning, for important aptitudes and values required to be a good professional and, above all, a good citizen.

For these reasons, spontaneously, the first people who heard it started to rename it the *rural Erasmus*, and we thought it was an attractive label, a good metaphor and marketing idea. No doubt the university world and transnational cooperation would be very different without Erasmus policy. So, the Desafío program would like very much in future resemble the Erasmus in that change of mentality, in favoring a generous and open exchange on innovation, sensibility and creativity between the rural and the urban world. To have such nickname could be the beginning…

2. Main points

In any policy and strategy, it is possible to distinguish between goals, instruments and agents involved. We briefly describe them in order to explain *Desafío* Program, to contextualize their main issues.

2.1. Goals

1. Allow students to improve his academic, intellectual, professional and personal learning, as a result of carrying out the *Prácticas* subject in a company, organization or public administration from a small town in the province of Zaragoza. (Human capital)
2. Facilitate that companies, entities of the third sector, and public administrations contribute to the training of future graduates and master's degrees by putting into practice renewed knowledge and proactive skills that simultaneously improve the effectiveness and efficiency of their own business. (Efficiency and creativity for companies and local productive ecosystems and, at the same time, human capital for students).
3. Promoting social and economic regeneration of rural communities that welcome these new residents, so that the value of diversity is appreciated at the confluence of the usual neighbors and of young qualified and motivated newcomers,

generating links on both sides that lead them to an open minded and deeper coexistence. (Social capital -bridging and bonding-, and social cohesion).

2.2. Instruments

Economic and organizational support from the Diputación Provincial de Zaragoza (Provincial Council of Zaragoza) to facilitate the balance between a training offer in quality jobs and a demand for practical learning through the following means:

1. Information to managers, CEOs, civil servants, politicians in the rural area of Zaragoza, the opportunity to have between 120 and 300 working hours of university students in internship tasks, from the most suitable areas of knowledge.
2. Information to students from University of Zaragoza about the options to carry out their curricular and extra-curricular practices in companies of the rural environment of the province of Zaragoza that allow them to improve their personal learning.
3. Financial support for students, insofar as this kind of practice involves travel and accommodation fees, not in an urban environment, an important explicit cost, as well as supporting companies that are integrated into the program by co-financing remuneration on account of work performed.
4. Collaboration with Universa at the management of this entire program.

2.3. Agents involved

1. Employers, individually and through their sectorial associations.
2. Local Administration, Counties, Local Development Entities (Local Action Groups for Leader Programs-LAGs).
3. Government of Aragon, and its delegations at the local level.
4. Non-Governmental Organizations, Foundations, Agencies. (Third Sector).
5. University of Zaragoza, with its orientation and employment service, Universa.
6. Student associations: student organizations, student delegations, cultural groups.
7. Trade Unions and Agricultural Organizations.
8. Politicians and elected officials with responsibilities at the local level.

3. Results

On April 17, 2018, a collaboration agreement between Diputación Provincial de Zaragoza and the University of Zaragoza was signed in order to implement the *Desafío* Program. The Provincial Council contributed to the Universa service the total amount of 9,000 euros, which has been paid for accommodation, travel expenses and scholarships for participating students (including Social Security). There were 22 entities initially interested on (Table 1). They sent their requests for internships, which were assessed taking into account criteria

that favored small villages and local organizations, but also considering the suitability of performance. Above all, we account the ability of the internship to culminate a mature, autonomous, critical learning that fosters less developed skills in regulated teaching within the classroom. As the budget did not allow all the applications received to be addressed, after the assessment, those with the best score were prioritized. In total, there were 19 internship positions were broadcast.

Table 1. Organizations and Studies.

Organization	Studies required
Agrupación Defensa Sanitaria Porcino De Tauste	Veterinary
Asociación Sociocultural Purroy Unido	Fine Arts
Ayuntamiento de Aladrén	Engineering
Ayuntamiento de Herrera De Los Navarros	Pre-School Education
Ayuntamiento de Herrera De Los Navarros	Tourism / Marketing
Ayuntamiento de Herrera De Los Navarros	Law
Ayuntamiento de Jaraba	History / Tourism
Bodegas San Valero S. Coop.	Business Administration (and similar)
Comarca Ribera Baja Del Ebro	Information and documentation
Mermeladas Bubub S.L.U.	Business Administration (and similar)
Pueblos En Arte	Business Administration (and similar)
Pueblos En Arte	Fine Arts
Romanos Aljama S.L	Social Work
Romanos Aljama S.L	Occupational Therapy
Romanos Aljama S.L	Physiotherapy
Romanos Aljama S.L	Nursing
Senderos de Teja S.L	Business Administration (and similar)
Sat 1733 Granja San Miguel	Veterinary
Tomás Yagüe Colas	Veterinary

Source: Universa

As we can see from table 1, the most requested degrees were those in Economics and Business and Veterinary. The first ones are required for all kind of organizations, as they are useful for strategic functions but also for day a day affairs. Veterinary has to see with a specific reason, an important activity in rural areas of Aragón, intensive farming, which is increasing their production exponentially. Most of the pork industry is migrating from Netherlands and Catalonia, congested areas of people and pigs, to depopulated Aragón, as pollution generates negative externalities and in sparsely populated areas the need for jobs and economic vitality does not allow to be so meticulous.

Table 2. Studies Required.
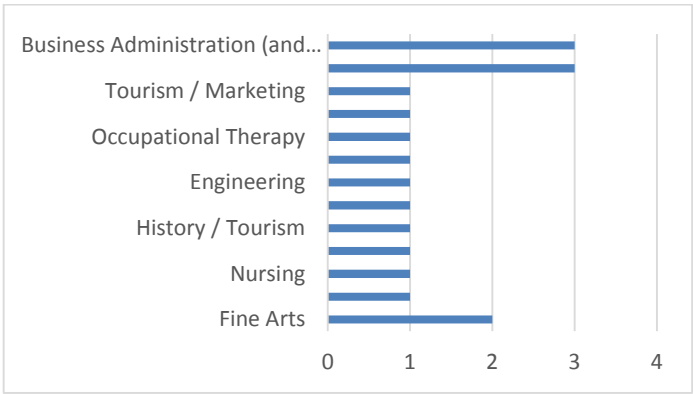
Source: Universa

To cover these offers, publicity was made by e mailing from University, social networks and particular emails of students enrolled in Universa. All the students interested in participating in the *Desafío* Program were selected by the applicant entity. Finally, 13 internships were managed in this Project. Finally, the most demanded studies were Veterinary, whose students covered 5 of the 13 internships, followed by Nursing, due to the aging of rural areas, and Law, polyvalent for local administrations.

Table 3. Desafío's Internships.
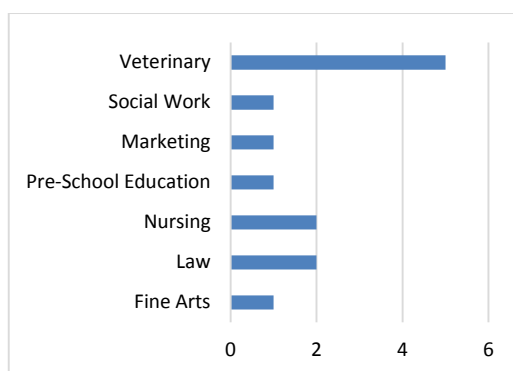
The average duration of the 13 practices has been 30.92 days, and the average payment amounts to 691.90 Euros (which includes the aforementioned concepts of accommodation expenses, travel expenses and study aid bag for the student - including Social Security). The distribution of the total budget, 9,000 euros, among the different concepts has been as Table 4 shows.

Table 4. Budget Distribution
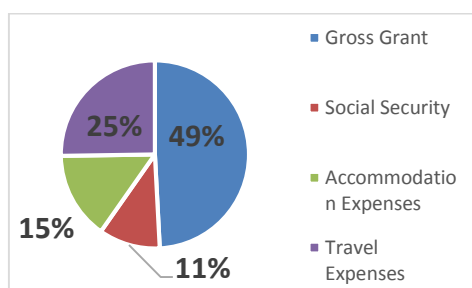
4. Conclusions

Desafío Program is a lab policy, which has been improved for the first time last course, but the first impressions, as the polls made by Universa showed, have been very positive, for the local communities, the organizations which employed them, and for students.

First of all, the change of residence from a city like Zaragoza (700,000 inhabitants) to a small village is not merely geographical, but much more sharp. It does not matter so much the physical distance, in our case very short, as the deep change of mentality, of context, of way of relating with people. In a small isolated community, the individual persons are

always relevant actors, and the values inspired by trust and compromise are often more determinant than prices and the market. There can be more contrast between the rural and the urban areas of the same province, than between two European cities placed in the uttermost situation. Perhaps, because of that, *Desafío* promotes diversity, maturing and open minded in a more robust and radical sense. So, pedagogically, it is a good option.

Also, we have to look for a higher responsibility of employers and rest of stakeholders. In this first year, they did not assume any cost, do not pay a euro and didn't participate in any reunion. There is a populist victimism discourse very rooted in depopulated areas, as if everybody ought to compensate them for everything. In part it is true that the rest of territories have to balance the public goods and possitive externalities they produce on the rest of society, take into account the problems associated to polarized growth, but at the same time rural citizens have to play their chances in a smart way, by themselves. For next editions, they should have to be more compromised in financial and functional aspects. A co-responsible designing of the program would be interesting.

About the instruments, we appreciate some specific questions. First, we perceived that students, despite knowing the conditions of the project, considered the amount of the scholarship insufficient, since, although accommodation expenses were covered, maintenance expenses are not, so they had to dedicate the grant to pay for them. So, an important part of the money was used to cover the expenses generated during the internship period. It would be advisable to add a new item to cover living expenses. Also, management of accommodation in remote rural areas is not professionalized, as their usual clients are families and not with companies neither public institutions. A simple bureaucratic paperwork involves a complexity that is not always easy to overcome. Finally, at certain types of internships (Fine Arts), it would be advisable to have a heading for variable expenses, to include, for example, the purchase of some materials for the execution.

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Photo 3D technology applied to e-Learning tools production for animal biology

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Abstract

The teachers from the Biology Department of the University of Lille have been developing for the last two years, a digitalization program of naturalist collections. This project aims to preserve this scientific heritage and to use it for animal and plant biology teaching. Specimens are digitalized by a photo 3D capture system, that produces a 360° and/or hemispheric images of the objects starting from high-resolution pictures. Based on the use of this particular imaging technology, teachers realized multimedia eBooks and a series of files "at the glance" for practical works in animal biology for Bachelor students in Life Sciences. These supports, enriched by graphic complements, texts, legends and interactive animations, are available on the pedagogic platform Moodle. These digital tools are viewable on computers and can be handled on smartphones and tablets for a nomad utilisation. Students generally consider these supports useful for learning and they consult these resources before, during and after the practical sessions. This distance-learning approach gives the students a complete autonomy for practical session preparation and reviews. The innovative tools here presented constitute a useful learning complement to classical academic lectures in animal biology.

Keywords: photo 3D; eBooks; e-Learning; anatomy; animal biology.

1. Introduction

Teaching of Biology in European Universities is generally based on classical academic lectures and practical sessions. The transition from the high school to the Bachelor environment requires the students more autonomy and a different way of studying. The amount of knowledge to acquire in term of vocabulary and content has consequently a negative impact on learning feedback. A group of teachers from the Biology Department of the University of Lille has been developing in the last years the usage of Information and Communication Technologies for Education (ICTEs) to improve learning and attractiveness of animal and plant biology for undergraduate students in Life Sciences. The aim is to produce student-centered innovative digital tools (videos, eBooks and photo 3D from naturalist collections) made available on the pedagogic platform Moodle for a free and unlimited access on different devices. Undergraduates can use these distance-learning resources to complete the study of face-to-face academic lectures and practical sessions content. This blended-learning approach allows them: a) to review the theoretical content of the academic lectures; b) to virtually handle the specimens of different animals illustrated during the practical sessions and c) to enlarge the knowledge on the subject through the lecture of the interactive digital tools as well as of the web sites available as hyperlinks. This project has the goal of fostering the autonomy and the comparative analysis capabilities of students as well as the exchanges between peers. In addition, the use of different devices like smartphones and tablets aims to improve their curiosity and involvement in studying biology. As an example of this e-Learning policy, we present here the production of a digital manual and a series of files for practical session in animal biology describing teeth features in relation to specific diets and skull evolution in Mammals.

2. Materials and Methods

2.1. Photo 3D capture system

The Biology Department of the University of Lille possess a naturalist collection regularly used for pedagogic purposes. Digitalization of this scientific heritage is performed using the PackshotCreator (Levallois-Perret, France) photo 3D system, equipped by five Canon EOS 700D digital cameras. Briefly, the shooting is performed on specimens placed on a rotating plate, which allows obtaining 360° and/or hemispheric HD (18 Million Pixels) images of the objects. The size of specimens can varies from 1 cm to about 100 cm. For small samples and/or details captures we used macrophotography lenses (Canon 100 mm Macro). A hyper focus system allows the production of perfectly sharp pictures. Images are exported under different formats (tiff or jpg) following their usage for printing, multimedia textbooks or web publication. Animations of photo 3D images are generated in HTML5 format with the

PackshotViewer software and are viewable on all Internet browsers. Photo 3D of these naturalist collections are available on the free access website http://photo3d.univ-lille1.fr/360/.

## 2.2. Interactive multimedia files and eBooks

The available photo 3D images were used to produce a series of files describing teeth's features and evolution in Mammals (http://photo3d.univ-lille1.fr/dents_et_regimes/index.html). Teachers entirely conceived these documents. Multimedia engineers treated single images with Photoshop (Adobe) to enrich them with legends and colours displaying specific elements of the different samples. Animations were realised with the Adobe Muse software.

We recently produced several multimedia eBooks made available for students for practical session preparation and review before learning feedback. These digital supports contain text, schemes, images, photo galleries, a glossary and other interactive widgets to explain and complete the work made during the lab session. The integration of hypertext links and QR codes into the eBook gives the students the possibility to directly point to the photo 3D database described above to observe and virtually handle the different samples. These digital resources, made with free software iBooks Author distributed by Apple, can be exported in iBook or pdf format for Apple or PC/Android users, respectively. These supports are so far available in French but English versions are being programmed for our Bachelor students of the bilingual (English-French) option.

3. Results

The University of Lille recently acquired a 3D photo capture system aimed to digitalize its scientific heritage. The Biology Department is producing a database of plant and animal collections to be used for didactic purposes (http://pod.univ-lille.fr/video/5946-une-nouvelle-vie-pour-des-collections-naturalistes-dantan/). Based on this context, a group of teachers developed a distance-learning project in animal biology for Bachelor in Life Sciences students aimed to illustrate, by digital tools, Mammals' teeth features according to their diet. The main learning objective of these innovative supports is to illustrate with texts, schemes and interactive 3D photos the set of teeth of different Mammals described during academic lectures and practical sessions. These supports are compatible with any digital device (computers, tablets or smartphones) and Internet browser. Students have access to these documents in the two weeks preceding the practical session. During the practical work, they observe the samples issued from the zoology collection and perform comparative analyses on skulls morphology/evolution as well as on the set of teeth in different animals. Finally, students use these digital resources to review before the final examination at the end of the semester. The 3D photos of selected specimens were used to

make a series of about 30 files "at the glance" describing the evolution, the number, the morphology and the action of teeth associated to different diets of Mammals (carnivorous, herbivorous, omnivorous,...) (Figure 1).
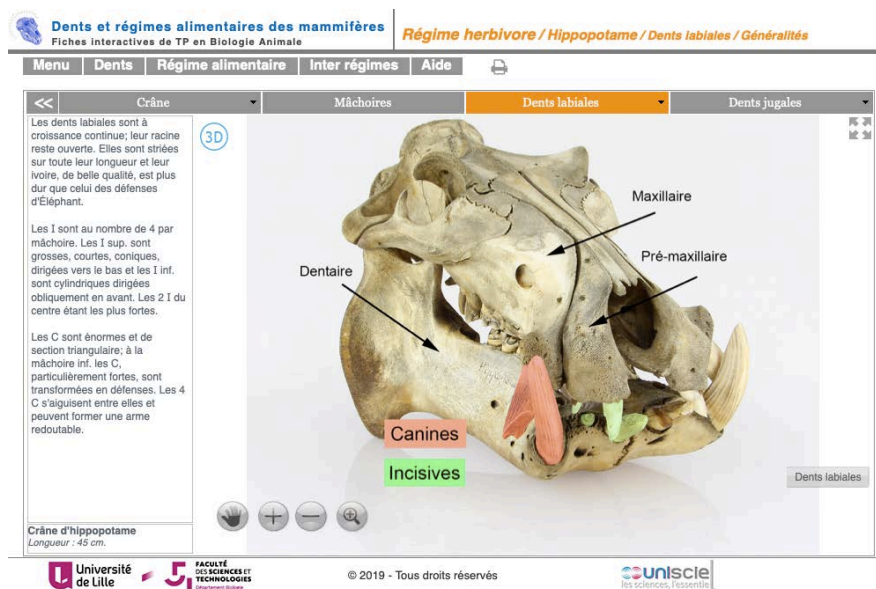
Figure1. Photo 3D of a hippopotamus skull as an example of herbivorous diet. Teeth names and positions are highlighted by coloured areas. Arrows indicate bones supporting the different types of teeth. The description of their features (quantity, shape, size,...) is shown on the left. Users can choose various tabs to see different regions of the skull and the related teeth. Mouse controlled rotation of the 3D image and the tools in the lower part of the windows give access to different zoom levels permitting to appreciate the details of the skull through high-resolution pictures. The upper menu allows navigating in the web site to observe the set of teeth and diets of other animals.

These documents are mainly intended for preparation and review of practical session on animal evolution and adaptation unit (BSci2). A questionnaire was submitted to a sample of students (n=38) to have a feedback on the usage of these tools. In general, results indicated these supports as easy to use for most of them (92.1%). The files were viewed on both computers (81.6%) and tablets (18.4%). Students used these digital tools to prepare the practical session (13.2%), to review before exams (50%) or both (18.7%). A few of them declared the files useless for learning or redundant with the eBook content (7.9%). Some students did not answer this question (10.5%) or (Figure 2).
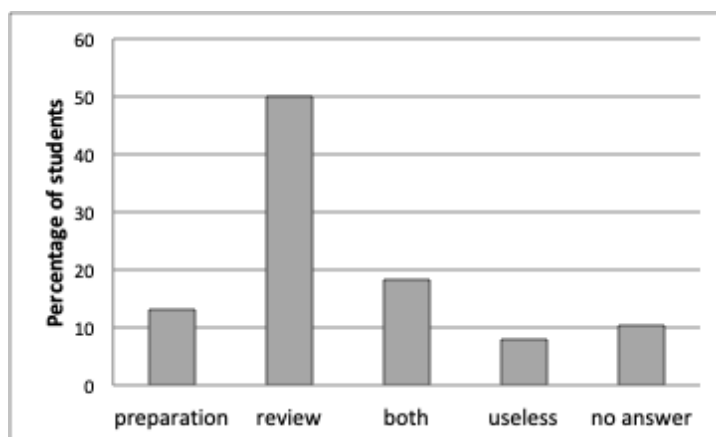
Figure 2. Digital files usage feedback. Histograms (n=38) represent the percentages of students using the files on "Mammals' teeth and diet" for practical session preparation and/or reviewing. Negative answers are also reported

These files were associated to an interactive eBook containing schemes, texts, images, a glossary and hyperlinks. This multimedia textbook resumes the main content on the subject and describes the adaptation of both teeth and skull features to the diet. This interactive tool is made available for viewing and downloading on the didactic platform Moodle in iBook or pdf format for Apple and PC/Android devices, respectively. In the period tested (February-June 2018) the eBook was viewed 297 times by the 153 students concerned by the related content. Some of them complained about the loss of interactivity (image galleries, videos and other widgets) using PC or Android devices respect to Apple ones. To solve this problem, we supplied additional pictures or QR codes redirecting towards specific videos at the end of the pdf version.

4. Discussion

This project is included in a larger program of valorisation and didactical use of the naturalist collections of the Biology Department of the University of Lille. The aim is to restore and preserve many ancient and fragile specimens as well as developing new ways to use them for Life Sciences teaching (Cook et al,. 2014). This goal passes trough the digitalization of this scientific heritage, which we perform with a photo 3D system. This kind of image capture approach is generally exploited by private companies and is mostly intended for e-Commerce. The usage here described constitutes, to our knowledge, the first example of naturalist collections digitalization associated to didactic purposes for higher education in Life Sciences. We integrated the use of 3D photos in our academic lectures and practical session on animal biology. Students observe these samples on their digital devices without any risk of damage of this historical heritage.

Based on the 3D images we developed a new project of files "at the glance" as a support for a practical session on teeth and diets in Mammals for Life Sciences (BSci2) students. These interactive files allow the virtual handling of specimens, favouring details viewing and anatomy knowledge. The use of these files, freely accessible on the web, can be easily extended to other university courses (eg. veterinary, educational sciences,...). In addition, because of their ease of use and pleasant presentation, they can be exploited for teeth and diet courses in middle and high school levels.

We also produced a series of multimedia textbooks in animal and plant biology for Bachelor in Life Science instruction. Students generally read and use these textbooks on their own computer or tablet. Smartphones are less used during the practical session, probably because of the reduced size of the screen that does not allow an easy viewing of images and written content. On the other hand, these mobile devices are mainly appreciated for their nomad utilisation and quick review of punctual subjects. Many students prefer downloading and printing the document: actually, during the practical session, they use the paper support to customize it with notes, printed screenshots, comments and legends. It is consistent with the report of George and collaborators indicating that the use of digital devises cannot replace printed handouts (George et al., 2013).

Taken together, practical files and the eBook are complementary resources: the first ones mainly favouring undergraduates' comparative analyses and observation skills, the second one mostly being a digital manual for the description of samples and practical session content. In addition, the eBook allows widening and consolidate the knowledge by specific inset, hyperlinks (e.g. web pages, videos) or quizzes about the treated subject. Students' feedback on these multimedia tools is positive in terms of usefulness and autonomy gain during the practical sessions. This result is consistent with the observation of Mayfield and colleagues that noticed a less seek of instructors during practical work on human anatomy in case of availability of digital supports (Mayfield et al., 2013). The production of such interactive eBooks in biology fields is at present poorly developed. Indeed, multimedia resources were just described as useful for chemistry (Jordan et al., 2016) and molecular biology (Laneuville & Sikora, 2015) learning. The use of tablets and e-Learning strategies were reported as relevant for human anatomy teaching (Trelease, 2016; Scibora & Mead, 2018) and other educational fields (Nguyen et al., 2015). The usage of our digital documents before (preparation), during (observation and analysis) and after (review) the practical session resulted coherent with the didactic objectives of the project. Our experience of blended learning strategy, coupling academic lectures and practical work with non-attendance-based teaching, resulted positive in term of students appreciation and learning feedback, as previously reported for human anatomy teaching (Pereira et al., 2007). This is why we wish to carry on and develop this student-centered program of e-Learning tools production, which effectiveness was already established for biology

instruction (Connel et al. 2016). In addition to face-to-face instruction, which remains a necessary way of teaching for academic education, the association of 3D photos with other multimedia tools appears as a useful approach for distance-learning and constitutes an innovative potential for biology teaching.

Acknowledgements

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Whiteboard Animations for Flipped Classrooms in a Common Core Science General Education Course

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Abstract

Whiteboard animation, an engaging tool for teaching and learning, consists of a series of hand-drawing illustrations with voice-over narration to explain complex and abstract ideas. Our team had produced four short whiteboard animations tailor-made for a common core science general education (GE) course. This study aims at evaluating the effectiveness of using these whiteboard animations for flipped classrooms in the common core science GE course. The pre-tutorial survey showed that students who watched the animations got significantly higher average marks in the quizzes at the beginning of the tutorials (p<0.001). The post-tutorial feedback survey indicated that the whiteboard animations attracted 67% of students to watch the animations. For students who watched the animations, over 86% of them reported that the animations raised their interest in the issues discussed in the tutorial classes, and learning materials in the form of whiteboard animation were more interesting than lecture videos; more than 90% of the students agreed the whiteboard animations were helpful in (i) understanding the assigned readings, (ii) clarifying the concepts of the discussed issues, and (iii) gaining the related knowledge before the tutorial. We concluded that whiteboard animation is an effective and engaging tool for flipped classrooms in the common core science GE course.

Keywords: whiteboard animation; flipped classroom; common core; science education; general education; In Dialogue with Nature.

1. Introduction

Whiteboard animation is an increasingly popular form of educational media. It consists of step-by-step illustrations with voice-over narration to explain complicated concepts and abstract ideas in an attractive and enjoyable way. The line drawings are visual design elements which influence learners' emotions and foster learning (Um *et al.*, 2012). For instance, Türkay (2016) demonstrated that whiteboard animations have a significant positive effect on retention, engagement, and enjoyment in conveying physics lessons. Türkay and Moulton (2016) also found that whiteboard animation is beneficial for learning in social science lessons in terms of learning and subjective experiences of enjoyment and engagement. These studies support the usefulness of whiteboard animation in specific disciplines but its effectiveness in common core courses, which students come from different disciplines, remains unexplored. Hence, we would like to study how does whiteboard animation help the teaching and learning in a common core course.

This project was carried out in the context of the common core science general education (GE) course *In Dialogue with Nature* in The Chinese University of Hong Kong. This course engages students in reflecting our understanding of the physical universe, the world of life, and scientific and other worldviews through the reading of great books and stories of the influential philosophers and scientists (Chan *et al*., 2016). Students are required to study the assigned readings before attending interactive tutorials each week. Given that about 3,600 students from different disciplines enroll in the common core course each year, students' diverse backgrounds lead to various pedagogical concerns. For instance, students without science background have lower confidence in reading science-related texts in general (Kiang *et al.*, 2015). Lau *et al*. (2018) reported that science education in high school and religious background contributed to the different views on the nature of science. Teaching and learning this science classic-reading common core GE course is challenging. The lack of prerequisite knowledge, misunderstanding of concepts, inadequate comprehension of abstract ideas, and inability to connect different texts are the students' common obstacles for studying this course. Teachers need to sacrifice lots of time in the tutorial to deal with these obstacles, which means the tutorials have less time for thoughtful discussion and less productive than it could have been. Given this, we have explored the development of whiteboard animation as an innovative teaching and learning tool for flipped classrooms (Li *et al.*, 2017). In this study, we would like to evaluate the effectiveness of using these whiteboard animations for flipped classrooms in the common core science GE course. In brief, the pre-tutorial and post-tutorial feedback surveys were used to evaluate the effectiveness of the whiteboard animations in equipping students' prerequisite knowledge before and during tutorials. The engagement, motivation and habit of watching the whiteboard animations are also studied in this paper.

2. Methodology

2.1. Implementation

Four whiteboard animations ("UGFN-animated", 2018) were tailor-made to flip the classrooms in the common core science GE course according to Li *et al*. (2017). Each animation is about five minutes long in two languages (English and Chinese). The two animations, "What is life?" (Figure 1) and "Does DNA determine you?", are related to the scientific inquiry of life and were designed to flip the classrooms of the tutorials discussing James Watson's *DNA: The Secret of Life*. The other two, "Where does our mind come from?" and "Do we have free will?", are related to the scientific inquiry of mind and were designed for the tutorials discussing Eric Kandel's *In Search of Memory*.

Figure 1. The whiteboard animation "What is life?" developed in this project. The left panel shows the drawing process of the illustrations. The right panel shows the big-picture.

In this study, the animations were provided to the students of 15 tutorial classes (25 students in each tutorial) in the first semester of 2016-17. To flip the classrooms, we encouraged students to watch the whiteboard animations at their own pace before attending the tutorials. During the tutorials, when students discussed the topics related to the scientific inquiries of life and mind, the big-pictures of the whiteboard animations were displayed to aid the discussions when necessary.

2.2. Evaluation

Two surveys were used to evaluate the effectiveness of the whiteboard animations. The aim of the first survey, the pre-tutorial survey, is to evaluate the effectiveness of the animations on equipping students with the prerequisite knowledge before the tutorials. It was conducted in the form of quizzes at the beginning of the tutorials, and more than 280 students participated in it (Table 1). For each animation, two multiple-choice questions about the prerequisite knowledge necessary for discussion in the tutorial were asked. Students were also asked to indicate whether they did or did not watch the animations. The marks of the students who did and did not watch the animations were compared using the unpaired t-test. A sample question of the quiz is given below.

Which of the followings about the process of DNA decoding is/are correct?
i. Understanding the mechanism of gene expression means understanding the process of decoding the code of life;
ii. After transcription, the mRNA will leave the nucleus and then cut and processed;
iii. In translation, each coding unit contains two nucleotide bases.
(A) i only (B) i and ii only (C) ii and iii only (D) i and iii only (E) I do not know

The aims of the second survey, the post-tutorial feedback survey, are to collect students' feedback on the reasons of watching (and not watching) the whiteboard animations, and to evaluate to what extent these animations help them prepare the discussions in the tutorials. Students were invited to fill in the survey after the tutorials and feedbacks from 333 respondents were included in this study.

Table 1. Comparison of the quiz performance in the pre-tutorial survey between students who did and did not watch the four whiteboard animations before tutorials.

	Quiz 1			**Quiz 2**			**Quiz 3**			**Quiz 4**		
Animation	**What is life?**			**Does DNA determine you?**			**Where does our mind come from?**			**Do we have free will?**		
Group	Watch	Not	Δ	Watch	Not	Δ	Watch	Not	Δ	Watch	Not	Δ
Student no.	177	127	50	169	138	31	181	104	77	176	104	72
Student (%)	58.2	41.8	16.4	55.0	45.0	10.1	63.5	36.5	27.0	62.9	37.1	25.7
0 marks (%)	54.8	72.4	-17.6	33.1	73.9	-40.8	11.6	72.1	-60.5	13.6	71.2	-57.5
1 mark (%)	35.6	23.6	12.0	34.3	21.7	12.6	19.3	22.1	-2.78	34.1	24.0	10.1
2 marks (%)	9.6	3.9	5.7	32.5	4.3	28.2	69.1	5.8	63.3	52.3	4.8	47.5
Average mark	0.55	0.31	0.24*	0.99	0.30	0.69*	1.57	0.34	1.23*	1.39	0.34	1.05*

Δ: The difference between students who did and did not watch the animation (i.e. "Watch" minus "Not").
*Statistical significance in the unpaired t-test with p-value <0.001.

3. Results and discussion

In this study, the effectiveness of using these whiteboard animations for flipped classrooms in the common core science GE course was evaluated. The pre-tutorial survey showed that 55.0% to 63.5% students, with an average of 59.9%, watched the four whiteboard animations before the tutorials (Table 1). In general, students who watched the animations before the tutorials performed much better than those who did not. For example, less than 5.8% of the students who did not watch the animations got full mark (i.e. "2 marks") in the quizzes, while for those who watched the animations the percentages are much higher

(9.6%, 32.5%, 69.1% and 52.3% in the quizzes 1 to 4, respectively). More than 71.2% of the students who did not watch the animations got "0 marks", while for those who watched the animations the percentages are much lower (54.8%, 33.1%, 11.6% and 13.6% in the quizzes 1 to 4, respectively). For all the quizzes, students who watched the animations got significantly higher average marks than those who did not ($p<0.001$, Table 1). These data suggested a significant positive correlation between watching the animations and understanding of prerequisite knowledge before tutorials. Then, the areas of how and to what extent these animations helped students prepare the discussions in the tutorials were investigated. In the post-tutorial feedback survey, 67.3% students reported that they had watched the whiteboard animations. 92.1% of these students agreed in different degrees (including "slightly agreed", "agreed", and "strongly agreed") that the animations were helpful in gaining the knowledge of life and mind before tutorials (Figure 2). 90.9% and 92.7% of the students agreed the animations were helpful in understanding the texts and in clarifying the concepts of the discussed issues, respectively. All these findings indicated that the animations helped equip students with the prerequisite knowledge before tutorials.
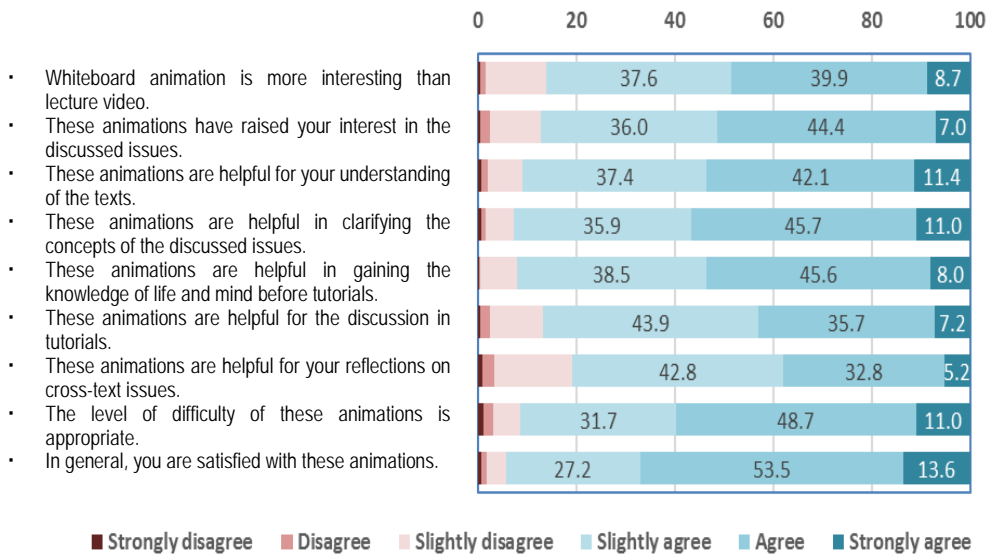
Figure 2. Views from the students who watched the whiteboard animations in the post-tutorial feedback survey. A six-point Likert scale (from 1 "strongly disagree" to 6 "strongly agree") was used to indicate the degree of agreement on the statements. The figures are in percentage.

The next question asked was whether the whiteboard animations are helpful for discussion *during* the tutorials. The feedback survey revealed that 86.8% of the students agreed these animations were helpful for the tutorial discussions (Figure 2). This finding is in line with the observations of the teachers that some students used the examples in the whiteboard

animations to support their arguments during the tutorial discussions. Some students referred to the concepts in the whiteboard animations to refute their classmates' arguments, correct their mistakes, and clarify the concepts. Also, 80.8% of the students agreed that the animations helped them reflect on issues across different texts. All these findings indicated that the animations are useful for students to better prepare for and discuss in the tutorials. Some of their comments in the feedback survey are shown below.

"*The content is interesting. The animations are lively and help me understand the content*"; "*The expression and explanation in the whiteboard animations are clear and concise. They bring up questions for reflection.*"; "*The whiteboard animations are clear. They are helpful for understanding and learning, especially for students who didn't study biology [in high school]*".

These encouraging comments suggested that the animations were well received by the students. In particular, students who did not have the science background may find this course intimidating. Hoi *et al*. (2017) showed that 60-70% of students studying the common core science GE course reported science anxiety and the anxiety situation varied among faculties. This is one of the reasons to tailor-make the whiteboard animations to suit the need of non-science students. With careful design of the storyboard, the whiteboard animations can provide the prerequisite knowledge required by the course at an appropriate level. In this project, 91.4% of the students thought that the level of difficulty of the four animations is appropriate, and 94.3% of the students were satisfied with the animations in general (Figure 2).

While effectiveness is one of the major concerns, how to engage the students is another key issue worth studying. Overall, 87.4% of the students said that the animations had raised their interest in the issues discussed in the tutorial classes and 86.2% of the students agreed that learning materials in the form of whiteboard animation are more interesting than lecture video (Figure 2). These data aligned with a recent report that our whiteboard animations are more effective and interesting than studio recorded lectures and recorded student discussion (Cheung *et al.,* 2018). Although the animations had already attracted more than two-thirds of the students, we would like to explore how to engage more students by knowing their motivations and habits of watching the animations. Students were asked to indicate why (or not) and when they watched the animations by checking one or more options in the post-tutorial feedback survey.

For motivation, most of the students watched the animations due to their teachers' recommendation (89.2%, Table 2) which suggested that promotion by teachers is the most important. 37.3% students said they wanted to learn from the animations. 50.9% and 42.7% of the students watched the animations when reading the texts and studying the lecture PowerPoint slides, respectively, and 15.1% students watched the animations 30 minutes

right before the tutorials. These data suggested that some students valued the animations as study companions when studying the course materials and preparing for the tutorials. 27.9% and 22.1% of the students reported that they were interested in the topics and were curious about the animations, respectively, which implied the content of the animations and the new learning experience contributed to the motivation of watching. Among the 67.3% students who watched the animations, most of them (84.1%) watched the animations for one time, while 15.9% students watched them twice or more (Table 2). It is noted that the students who did not watch the animations were mainly because of mere forgetfulness (47.7%) and having no time to watch (55.7%). Ensuring students to watch the online materials is challenging in flipped classroom practices which assume students' responsibility for their own learning. Sending reminders, setting assignments and formal quizzes may help. In this study, we have shown the effectiveness and engagingness of whiteboard animations. We hope that understanding students' motivations and habits of watching can provide useful insights into the development of better whiteboard animations to support teaching and learning.

Table 2. Motivations and habits of watching and not watching the whiteboard animations collected in the post-tutorial feedback survey.

Why did you watch the animations? (can choose multiple options)	Option	Recommended by teacher	Recommended by friends or classmates	Interested in the topic	Out of curiosity	Want to learn from the animations	Others
	Student (%)	89.2	2.8	27.9	22.1	37.3	2.4

When did you watch the animations? (can choose multiple options)	Option	When taking the school bus	When taking other transportation	When studying lecture slides	When reading the texts	Within 30 minutes before tutorials	Others
	Student (%)	1.5	2.1	42.7	50.9	15.1	11.8

How many times have you watched the animations on average?	No. of time	One	Two	Three	Four	Five	>Five
	Student (%)	84.1	13.5	1.4	0.9	0.2	0

Why didn't you watch the animations (can choose multiple options)	Option	Didn't know they exist	Didn't have time	Not interested in the topic	Forgot to watch	Already good at the topic	Others
	Student (%)	5.7	55.7	3.0	47.7	5.4	6.8

4. Limitations of the study

The pre-tutorial survey shows a correlation between watching the animations and understanding of prerequisite knowledge before tutorials. One should note that it is a significant positive correlation but does not necessarily imply causation. We cannot exclude the possibility that students who watched the animations are more active, attentive, hardworking, knowledgeable, and hence lead to better performance in the quizzes. Besides, some students in this study may not have experienced learning using lecture videos. Their response to the related question ("whiteboard animation is more interesting than lecture video") in the post-tutorial feedback survey may not be accurate. A rigorous study to compare the effect of these two forms of teaching and learning materials using the same content and under the same context would be the most insightful.

5. Conclusions

Technology advancement has assuredly benefited teaching and learning in this digital era. This study showed that the tailor-made whiteboard animations helped students prepare better before coming to class, raise students' interest in the discussion topics, and deepened their discussion and reflection in the tutorials. These animations are effective and engaging tools for flipped classrooms in the common core science GE course. They provide a unique learning experience for the students which make learning easy and fun.

Acknowledgments

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Lights, camera, action: Microbiology laboratory teaching in the spotlight

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Abstract

Broadening of access to higher education, leading to increasing class sizes, presents particular challenges in teaching specialised, laboratory-based subjects such as Microbiology. The Republic of Ireland has seen a 20% increase in undergraduate student numbers in the past ten years, with this trend set to continue in the near future. To complement traditional learning approaches, we have designed, produced and trialled a comprehensive suite of teaching videos that demonstrate common techniques taught in our Microbiology degree programme. The 42 videos, each of 4-9 minutes duration, were filmed in-house using a professional film maker. Videos were designed for viewing before linked laboratory sessions to increase student engagement, assist learners with little prior technical experience to process core concepts, and improve the quality of hands-on practical training in the laboratory. Student reaction to a pilot release was exceptionally positive, underlining the videos' effectiveness for visual learners and the added value of the content due to its bespoke nature. The complete video collection will be amalgamated into our B.Sc. programme in 2019-20. The initiative is expected to enhance students' experience in hands-on laboratory sessions, promote active learning by blending video into traditional teaching programmes, and support reflective study through their availability.

Keywords: visual learning; instructional videos; microbiology; laboratory; blended learning.

1. Introduction

Technology and the digital world have brought about radical and rapid change in the way knowledge is accessed and disseminated. According to Siemens (2005), learning is no longer an individual or solo activity but has been replaced by something that is performed collectively. Traditional methods of teaching have been eclipsed by the alternative of flipped learning. Once viewed as a means of allowing learners to engage with lecture material (Lage *et al.*, 2000), this has now transformed into a pedagogical approach in which students are provided with material prior to their class to enabling a more active learning environment to develop during timetabled class time. In addition, it provides an opportunity for students to deepen their understanding of course materials through active learning exercises, assigned activities, laboratory sessions and other practical applications. In this approach, students present for class pre-prepared for the relevant material through watching instructional videos or researching materials assigned by the teacher. In resource-intensive laboratory environments in particular, the primary focus can now shift to helping students with individual difficulties and to more complex techniques (Bergmann and Sams, 2012). This flipped classroom approach blends face to face learning during contact hours with distance learning outside of class (Halili and Zainuddin, 2015). Coupled with blended learning, this flipped classroom structure creates a student-centred approach to learning in which the instructor serves as facilitator and motivator whereas the student comes to the fore and is more active in the classroom (Bergmann and Sams, 2012). This allows students to better dictate their own pace of learning, and to be more effective and focused in the classroom (Fulton, 2012).

1.1. Background and Motivation for the Work

The Discipline of Microbiology at the National University of Ireland, Galway has amassed over 50 years of teaching and research excellence in the fields of infectious diseases, environmental microbiology and marine microbiology. Teaching programmes include a four-year B.Sc. programme in Microbiology, as well as postgraduate Diploma, Masters and Ph.D. programmes. The B.Sc. is a very popular choice with undergraduate students, resulting in large student cohorts from 1st year (approximately 620 students), through 2nd (210) and 3rd (150) years, to final year (60). With this in mind, we identified the potential benefits to our students of creating a repository of instructional videos to cover essential laboratory-based methods, to complement traditional teaching approaches. Online searches revealed a dearth of technical videos detailing fundamental techniques and threshold concepts over the breadth and specificity required. We therefore undertook to develop a suite of teaching videos, demonstrating microbiology techniques, that would be freely available online to second and third level institutions and other interested parties. The goal of this e-learning initiative was multi-faceted: to promote student engagement in our taught programmes; to increase the

quality of our practical and theoretical training courses; to ease the progression to third level of students from non-technical backgrounds; and to enhance NUI Galway's, and the Discipline of Microbiology's, international profile in the biosciences field and in research-led teaching.

2. Methodology

2.1. Project Design

Academic and technical staff involved in delivery of the 2nd and 3rd year Microbiology programmes were canvassed to compile a list of techniques for inclusion in the project. Staff were tasked with identifying techniques with core threshold concepts that are difficult to demonstrate to a large student cohort and whose teaching would be expected to be improved by the availability of a dedicated video resource. Duplicate suggestions were eliminated and a short-list of techniques was circulated to academic and technical staff for feedback. More complex methods were divided into autonomous sections to keep videos to 4-9 mins in length where possible. Five equipment instruction videos, appropriate for Health and Safety-related training of final year undergraduate and postgraduate students, were also included in the list. The final list of 42 videos was used in a funding application and in procuring a film maker partner for the project.

2.2. Preparation for Filming

A filming location was selected during an initial site visit by the film maker. The selection prioritized using a laboratory environment familiar to target student groups in order to increase engagement with the final product, and aspects such as light quality and uninterrupted availability for ten weeks. Four PhD students, with collective expertise in the techniques to be filmed, were hired and each allocated the filming space for two weeks to prepare for and practice their respective techniques. All equipment and reagents were provided exactly as used in the target laboratory teaching sessions. In a final run, each technique was filmed, from a single viewpoint, using a fixed digital camera. These "home-made" videos (see Figure 1(a)) were supplied to the film production company to provide an overview of video content and timing guide prior to formal filming of the desired videos.

2.3. Filming Process

Filming took place on the NUI Galway campus over eight days in June 2018. Three cameras were used: overhead, elevated to the students' right, and over the students' left shoulder (see Figure 1(b)). Additional lighting was used when necessary. Extensive filming and re-takes were carried out over days one and two, after which videos were filmed at a rate of

approximately six per day. Audio was recorded later in the university recording studio, with the help of personnel from the Centre for Learning and Teaching (CELT).

2.4. Post-production

Editing of three camera feeds and audio occurred over a six-month period from September 2018. Batches of four to eight video drafts were typically provided by the film maker for review. After incorporation of the authors' suggested edits, a meeting between film editor and authors to resolve remaining questions completed each two-week cycle. Each video required a minimum of three iterations of this process. Additional audio was recorded during the editing process for incorporation into a number of videos. The intro and outro were finalised through a similar process, with the former combining views of the NUI Galway campus with laboratory images, and the latter crediting contributors to the videos and the source of funding. Finally, a dedicated YouTube channel was created for widespread, free distribution of the final suite of videos.

2.5. Pilot Release and Feedback

During post-production, two batches of three videos each were shown to 2nd year (n=210) and 3rd year (n=41) Microbiology student cohorts, as part of teaching of the relevant techniques in scheduled laboratories. In the former group, video resources had not previously been used in formal teaching. For the latter group, students had previously been directed to available video resources online, which covered the same experimental techniques but with some technical differences from their laboratory practices. Both groups were surveyed using an anonymous questionnaire and data processed using Excel.

3. Results

3.1. Video Production and Editing

Funding was secured for the two-year project in May 2017 from NUI Galway's Student Project Fund, an internal competitive funding source with priorities such as the development of online teaching resources and supporting the transition of students to Higher Education. Slipjig Media (www.slipjigmedia.com) were contracted in November 2017 to film the videos and a project manager and four PhD students with appropriate expertise were selected in April 2018 after an open call for applications to Microbiology researchers. Initial videos were assembled by the film editor and reviewed by the authors and project manager. This process identified extensive edits to video content, editing and re-timing of audio, and insertion of labels and other highlights to pinpoint specific video content and emphasise core concepts. Reviewing and editing of drafts was staggered but all 1st drafts were completed by December 2018, 2nd drafts by January 2019 and final versions will be completed by February 2019. Pre-

final versions of all videos will be viewed by three members of staff prior to proceeding to final production.

The suite of videos (Figure 1(c)-(f)) presents core theoretical concepts in the biosciences and spans a wide spectrum of methods, ranging from fundamental bacterial culturing methods, through the use of commercial microorganism identification tests, to more sophisticated techniques to analyse DNA and protein molecules. Instruction videos for the use of Health and Safety-related instrumentation have also been included.
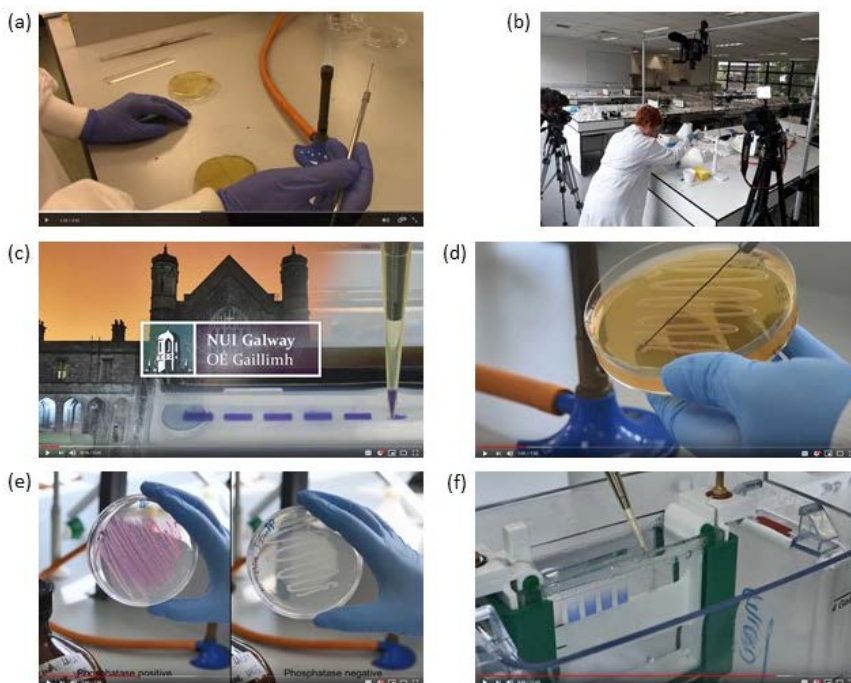
Figure 1. (a) Screen shot from in-house video. (b) Laboratory set-up with professional film company. (c) Sample screen shot from common introduction of videos. (d)-(f) Sample screen shots from videos demonstrating (d) bacterial culturing, (e) biochemical characterisation of microorganisms and (f) protein analysis techniques.

3.2. Student Evaluation

After viewing in the appropriate laboratory practical sessions, completed feedback forms on pre-final videos were returned by 155 (n=201; 73%) 2nd year and 41 (100%) 3rd year Microbiology students. In the case of 2nd year classes for whom video-based learning was new in their course, 94% of students responded that the video material helped them to engage better with the content of the laboratory session (Figure 2). A large majority of students indicated that the videos were very (87%) or slightly (11%) helpful to them in subsequently carrying out the techniques in the laboratory, while 84% expected they would watch the

videos as preparatory material for laboratories and 95% of respondents expected the videos to be helpful as study aids after completion of the hands-on training. Of the students who provided additional comments, the most frequent feedback (9/15 comments) concerned the high value of the videos for visual learners and visual learning.

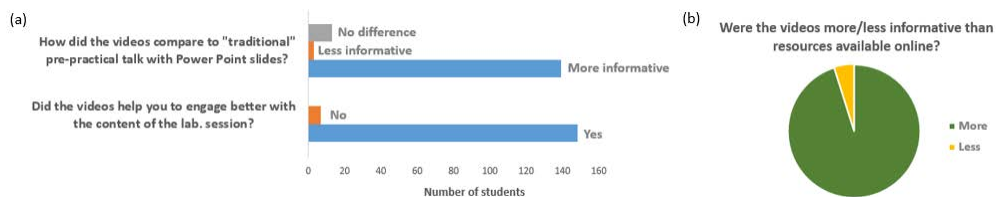*Figure 2. Sample results from pilot survey of (a) 2nd year and (b) 3rd year Microbiology students.*

For the 3rd year class who were accustomed to using videos in their learning, albeit not adapted to their equipment or procedures, 95% found the "in-house" videos to be more informative for their learning than those available online. Again, large majorities of students indicated that they would watch the videos in preparation for lab sessions (100%) or later as a revision/study aid (98%). Of the 73% of students who supplied additional comments, the most recurrent theme (9/30 comments) was the value added to students' learning by using bespoke rather than generic resources, which respondents identified as sometimes poorly suited to the technical requirements or precise goals of the laboratory session.

4. Discussion

Cursory inspection of the research literature highlights that at third level, the ever increasing large class size poses particular problems for staff and students alike, often contributing to less effective teaching and learning (Mulryan-Kyne, 2010). While traditional lecturing still remains the predominant teaching approach used for large student groups, the incorporation of educational videos has now become an important part of the curriculum, providing an important content-delivery tool in many flipped, blended and online classes (Brame, 2016). In addition, several meta-analyses have shown that technology can actively enhance learning (Means et al., 2010; Schmid et al., 2014), and numerous other studies have shown that video, specifically, can be a highly effective educational tool (Allen and Smith, 2012; Kay, 2012; Stockwell et al., 2015).

At the outset of this project, our objective was to create online instructional videos, many demonstrating technically complex and miniature methods, which would be a valuable addition to our lecture-based teaching and traditional pre-practical talks. Preliminary feedback from the pilot evaluation indicates the video content produced was extensively

welcomed by students and is likely to promote self-study practices and increase competency-based skills in the laboratory.

A large-scale, student-centred study of the effectiveness of the videos is planned after their inclusion in teaching throughout the 2019-20 B.Sc. academic programme. The pedagogic value of the video collection to final year undergraduate students and Ph.D. researchers who demonstrate 2nd and 3rd year laboratory courses to develop teaching and science communication skills will also be evaluated. Finally, a GoPro-based approach in which students record themselves while carrying out techniques in the videos, followed by submission for grading and recognition in the form of a digital badge, is envisaged.

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Video tutorials as a support to the face-to-face teaching

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Abstract

Video tutorials are a useful tool that strengthens the face-to-face classes. This study focuses on the influence of videos on the perceptions of students in the subject Advanced Financial Transactions. The results of this analysis show a high level of learner satisfaction. They consider that videos help them to improve their learning outcome, since these reinforce the practical contents which have been previously taught in the master class. Videos allow students to be more proactive and autonomous in their learning. The findings support the relevance of integrating new educational tools in the university study programmes.

Keywords: E-learning; video-tutorial; learner satisfaction.

1. Introduction

During the first semester of the academic year 2018/2019, professors of the Financial Economy and Accounting Area at the University of Almería have launched an initiative to help students in the subject *Advanced Financial Transactions*, located in the 3rd year of Degree in Finance and Accounting, complementing their academic training in Financial Mathematics.

Among the financial products commonly used by individual investors and companies we find the bonds, both those issued by the State and those that come from the private sector (i.e. they are issued as a financial source by financial and non-financial companies). Its analysis and correct valuation are essential to make decisions, but its treatment presents certain complexity. In this sense, the first video tutorial carried out was "Calculation of the Internal Rate of Return (IRR) of a bond". This video shows to students a real and complete example, with all the connotations and difficulties that entails. These are related to the accrued interest to be acquire in the secondary market (Valls and Cruz, 2012). From a sequential approach, it is analyzed in a rigorous and simple way, in order that students can understand all the problems without difficulty. In this sense, students do not only learn how the problem should be laid, but also as it should be solved analytically through the Excel spreadsheet.

In general, when students receive their lessons in different subjects included in their study programme, they do so independently, without an interconnection between them. However, although the formal object of the different subjects is different, the material object is the same. This is particularly true in the Finance and Accounting Area. In that way, the same fact, such as the granting of a loan by a financial institution, is treated in both Financial Mathematics and Accounts. So, in our opinion, the close relationship between the different disciplines should be shown to students. Therefore, we decided conducted this video tutorial about "Amortized cost of a loan", where we explain in detail how this magnitude is calculated in one of the most frequent and real cases, a loan with indexed interest rate (Valls and Cruz, 2009; Cruz and Valls, 2014; Valls and Ramírez, 2014). In order to keep with the valuation criteria of the Spanish General Accounting Plan, this value should be estimated by the account manager of the company. It is a complex calculation which, in practice and due to its complexity, is not being applied with generality, so that it falls into a normative breach.

Thus, the emergence of several teaching tools and its implementation in the higher education are helping to improve the learning processes and outcomes of the students. The goal and results of this analysis are in line with previous studies (Harjoto, 2017; Jiménez-Castillo and Marín-Carrillo, 2013; Zhang et al., 2006). Videos help student to improve their outcome since these reinforce the practical contents which have been previously taught by the master class. Furthermore, the contribution of these videos goes further, because these material will be available to the students even when they reach their working life.

2. Survey methodology

The students' opinions are key to adapt this educational tool toward the requirements of the teaching-learning process and that it is as useful as possible. In light of the foregoing, the feedback process is essential. Thus, in December 2018, the video tutorials were made available to students on the virtual campus. Once students had watched the videos, a survey was carried out among them. This one had the following form:

1. Video tutorials are useful for the study of this subject.

2. Video tutorials help me understand the concepts explained in the face-to-face class.

3. Video tutorials are useful to complete my academic training in this subject, with respect to the explained in the face-to-face class.

4. My level of knowledge is appropriate to assimilate the content of the video tutorials that I have watched.

5. It has been difficult to me to understand the video tutorials due to the new concepts which appear in them.

6. The design (design, font size, etc.) used in the video tutorials is clear and attractive.

7. Video tutorials boost my autonomous learning.

8. The process of making a video tutorial is easy.

9. I'm qualified to create a video tutorial by myself.

10. My knowledge of the subject is enough to develop a video tutorial.

11. My knowledge of the computer tools is enough to produce a video tutorial.

12. The development of video tutorials should be considered compulsory and, valued as a percentage of the mark in the subject.

13. If the elaboration of video tutorials was compulsory and it supposed a percentage of the mark of the subject, what should that percentage be?

14. What video tutorials would you propose to be developed by the professor?

15. What video tutorials would you propose to be developed by yourself?

16. Comments and suggestions about video tutorials (positive and negative aspects).

The questions 1 to 12 should be valued between 1 and 5, where:

1. Totally disagree.

2. Disagree.

3. Indifferent/neutral.

4. Agree.

5. Strongly agree.

The questions 13 to 16 were set out as open-ended, so that students could speak freely on what they wanted.

3. Results

At the end of the semester, a total of 16 students responded to the survey voluntarily. Summarized descriptive statistics (frequency, mean and standard deviation) of the answers to the questions 1 to 12 are given in Table 1. Furthermore, Table 2 shows the distribution of our sample with respect to these variables (questions 1-12).

The statement "Video tutorials are useful for the study of this subject" has been evaluated with 4.5 points (8 students agree and 8 totally disagree), giving 50 per cent of thesurvey's studentsthe highest rating.

The statement "Video tutorials help me understand the concepts explained in the face-to-face class" has reached, on average, the highest score with 4.69 points (5 students agree and 11 strongly agree), giving 69 per cent of the surveyed students the highest rating.

The statement "Video tutorials are useful to complete my academic training in this subject with respect to the explained in the face-to-face class" has reached 4.5 points on average (giving 56 per cent of the students the highest rating), like the first question. However, this assertation shows a greater dispersion due to one student considers indifferent this tool.

The statement "My level of knowledge is appropriate to assimilate the content of the video tutorials that I have watched" has reached, on average, 4.31 points given that 9 students agree and 6 strongly agree (38 per cent).

The statement "It has been difficult to me to understand the video tutorials, due to the new concepts which appear in them" is viewed favourably. Most of the students are totally disagree (6 students) and disagree (7 students), while around 81 per cent consider the level of their knowledge appropriate to assimilate the video tutorials; and 19 per cent of students are feeling neutral about this.

The statement "The design (design, font size, etc.) used in the video tutorials is clear and attractive" has reached, on average, 4 points where 75 per cent of the students agree or totally agree, while about 25 per cent of the students are neutral. In this sense, it is necessary to emphasize that neither student considers it unattractive.

per cent; the other 2 students did not specify the weight over the total grade, but they said that it should be a low percentage.
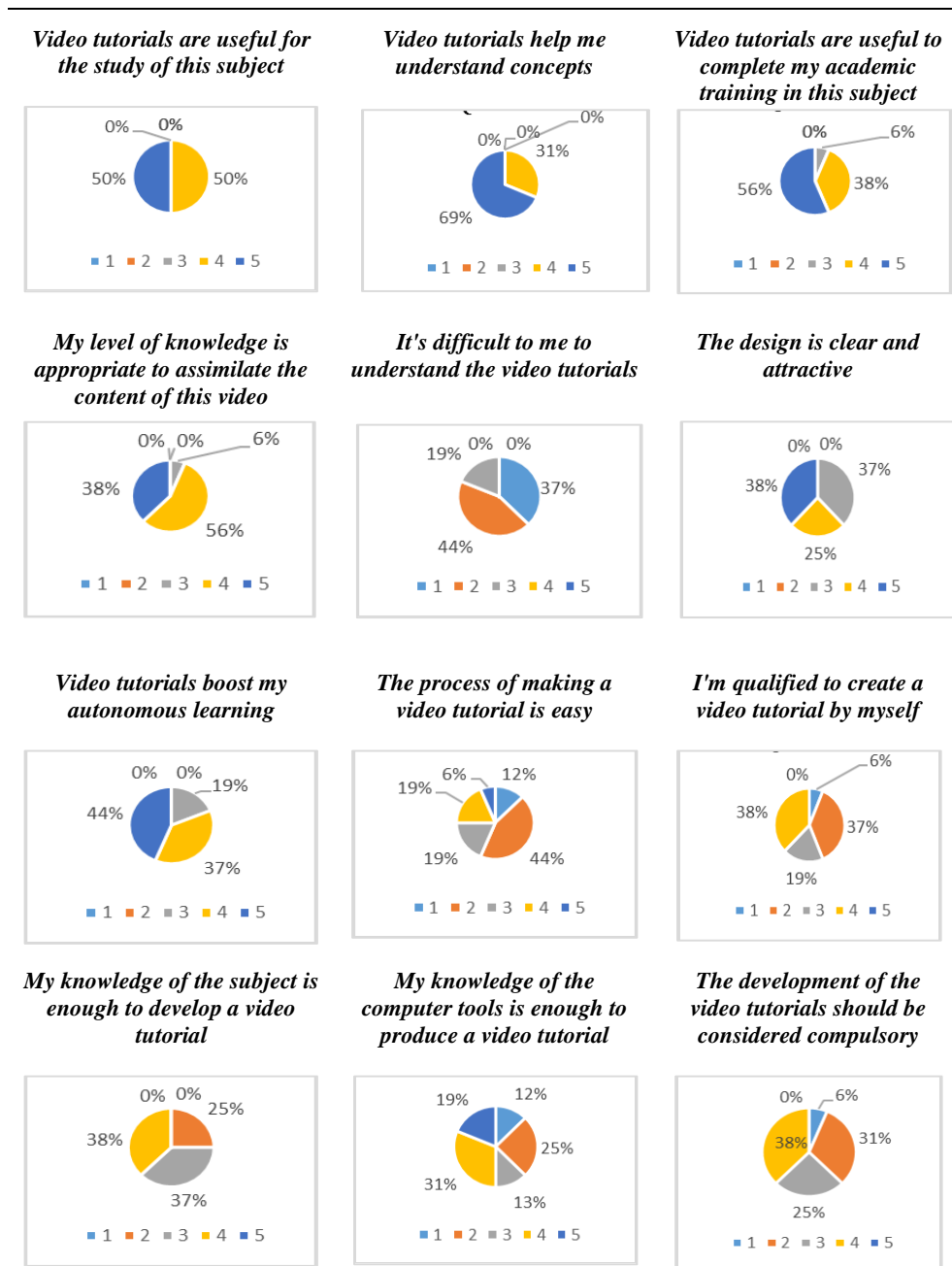
Figure 1. Percentage of question 1 to 12 . Source: Author's estimation (2018).

Considering the question "What kind of video tutorials would you propose to be developed by the teacher?", most of the students answered that they should be focus on the most difficult sections of the subject (pension fund, loans, etc.). Some students suggested that they preferred to have basic material about Financial Mathematics (2nd year of Degree in Finance and Accounting) about financial income and loan repayment methods.

Regarding the question "What video tutorials would you propose to be developed by yourself?", most of the students prefer videos about easy topics of the subject (for example, cash trade, etc.). One student proposed to split up the class into different working groups and that each one of them were responsible for a topic of the subject, supporting in addition, the teamwork. Another student proposed to produce one video for each topic, to commit himself to study the subject in detail and not leave the study for the end of the semester.

Finally, the open question about "Comments and suggestions about video tutorials (positive and negative aspects)" had the following answers:

- *Positive aspects:* It is easy to watch them when you want; the possibility of watching them several times (as many times as one needs); the possibility of rewinding the video when something is not clear enough; videos are clearly explained; the calculation process is shown; the development of video tutorials by the students would force them to study the subject in depth; it is a support for the study; if they were compulsory for the students, it would suppose an extra in the final mark; it makes the study more pleasant; it improves the students' learning and performance.
- *Negative aspects:* Regarding the calculations in the spreadsheet, it would be better to have a completed video rather than screen dump of the video tutorials; having the support of these tutorials can lead students to not attend class.

4. Conclusions

The most relevant results of this study are the following:

1. Video tutorials created by the teaching staff represent an useful complement for the students, strengthening and expanding their knowledge acquired with the face-to-face methodology. In this sense, students can watch these videos as many times as necessary at home, according to their necessities. In addition, during the tutorial they can stop and back, if they consider necessary to watch it again. Thus, they can consolidatethe topics more complex.

2. Video tutorials are a useful tool for the student to use it in their professional future, when they need to remember some of the topics explained in the subject. We must emphasize that the tutorials have a practical standpoint because the teachers have been based on real

examples of the financial market. Also, the videos explain, in a didactic way, problematic issues found in the professional exercise of the financial management and/or accounting.

3. The creation of video tutorials by students requires that they have previously studied the issue, to acquire the necessary knowledge for its development. Likewise, it requires that students have a good command of computer applications for its implementation.

4. The development of video tutorials by students provides them the knowledge and skills necessary to develop presentations for colleagues, bosses or clients in a future job.

Finally, our study has limitations that provide opportunities for further exploration. Our sample size and video tutorials were scarced. Thus, future research will extent this questionarie and the number of video tutorials to other courses in the Finance and Accounting Area to increase the number of participants.

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Students' experiences with the use of a social annotation tool to improve learning in flipped classrooms

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Abstract

To support the development and dissemination of more activating educational practices, pilot studies were launched on the use of the social annotation tool Perusall. Teachers of eight higher education course units agreed to work with Perusall in their classes. To assess the usefulness and effectiveness of Perusall we focused on two related aspects (1) perception by students of Perusall as an appropriate tool to support the processing of the study texts and (2) the impact of student engagement in Perusall on students' examination results. Student experiences were evaluated by means of online questionnaires about several aspects concerning the use of Perusall and log data about student activities in the Perusall platform.

The results of the study show that Perusall can foster engagement in deep level processing of course content but that the level of processing depends on three critical factors: the transparency of annotation assignments, the perceived ease of working in Perusall and teachers' use of students' annotations to discuss the course content during lectures. The study further shows that students receive better examination results the more they engage in the annotation assignments.

Keywords: Flipped classroom; Collaboration; Academic performance.

1. Introduction

In order to prepare students for a career after their studies, universities need to offer students opportunities to develop professional competences and skills as critical and creative thinking. Students in turn need to learn to seize the available opportunities to engage in critical and creative thinking and to apply what they have learned. One way to support the development of students in a role as active learners could be by designing lectures according to a flipped classroom approach, since this approach allows teachers to focus students' minds on further exploration of topics they have read before they come to class. The flipped classroom approach thus may be used to evoke discussions about learned material and to have students think about solving problems. The use of a social annotation (SA) tool could fit in with the flipped classroom concept.

In this paper we review the results of a university wide innovation pilot in which the SA tool Perusall was used by teachers of eight courses. This paper aims to investigate two related aspects of the use of Perusall in these participating course units: (1) students' perceptions of Perusall as an appropriate tool to support their processing of course content and (2) the impact of student engagement in Perusall (based on indicators derived from log data about students' activity in Perusall) on students' performance on examinations. Information about the predictive validity of engagement indicators based on log data could be useful information for teachers as it might allow them to provide early warning signals to students to increase their engagement. In this study setting we seek to address two main research questions:

1. Which aspects of the use of a social annotation tool in courses affect students' perception of engagement in deep learning?
2. Is the amount of student engagement in a social annotation tool related to the quality of their performance on assignments during the course and their examination performance?

1.1. Implementation of Perusall and evaluation of effects of student engagement

Perusall is an SA tool that allows teachers to ask students to study and annotate texts collaboratively before they come to class. In Perusal students create threads by highlighting text passages and posting questions or comments. Figure 1 shows the user interface of this annotation tool.
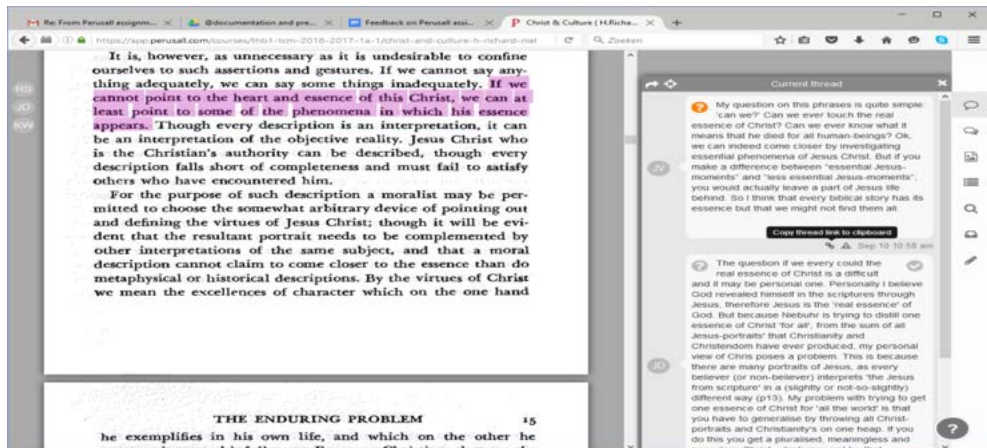
Figure 1. Example of a text fragment, as displayed in the webbrowser, with annotations and threads.

Perusall has the capacity to automatically assign scores to students' annotations as an indicator of the quality of each student's involvement in collective reading assignments. For in-depth evaluation of students' annotations to specified texts, teachers can command the Perusall platform to create so-called confusion reports that provides an overview of the content of students' annotations. By reading and analysing these reports, teacher can gain more insight into specific content that needs further clarification during lectures. This feature of Perusall can provide an impetus for both the quality of education and the professional development of teachers.

1.2. Evaluation of student learning engagement in Perusall

Essential for students' learning and the development of students' capacity to apply their knowledge is to ensure that students engage in reading and critical examination of texts, preferably before they come to class. This requires the use of higher order thinking skills such as comparing ideas, applying new concepts and evaluating arguments. Furthermore, those who come to class prepared are more likely to engage in discussions (Rahman & Manaf, 2017). Student learning engagement depends both on the time students invest in studying course content as well on the tactics they apply in educationally purposeful activities (Kuh, 2002). Research by Miller *et al*. (2018) indicates that having students perform regular annotation assignments in a secondary science classroom does accomplish better student learning outcomes. In line with this study we focus on investigating the impact of the time students spend reading texts in Perusall during a course, the number and the quality of annotation assignments the teachers gives students to perform.

1.3. Exploration of factors affecting students' engagement and learning

In this research project we studied the role of three critical factors that can facilitate or undermine student learning. It is to be expected that the quality of learning depends on:

1. the perceived ease of use of the annotation tool,
2. the nature of annotation assignments, and
3. the coverage of annotations by teachers to support students' understanding of the course content and the preparation for exams.

The ease of use pertains to reading and working within a digital environment. Transparency about the number and nature of assignments to annotate texts is a factor that could affect both students' engagement in Perusall as well as the quality of executed assignments. The perceived coverage by teachers during lectures of the information reflected in students' annotations can be an additional critical factor. Some students may need more clarification of course content, while other students value exploration and discussion of more difficult topics.

The basic framework for our investigation is displayed in Figure 2.
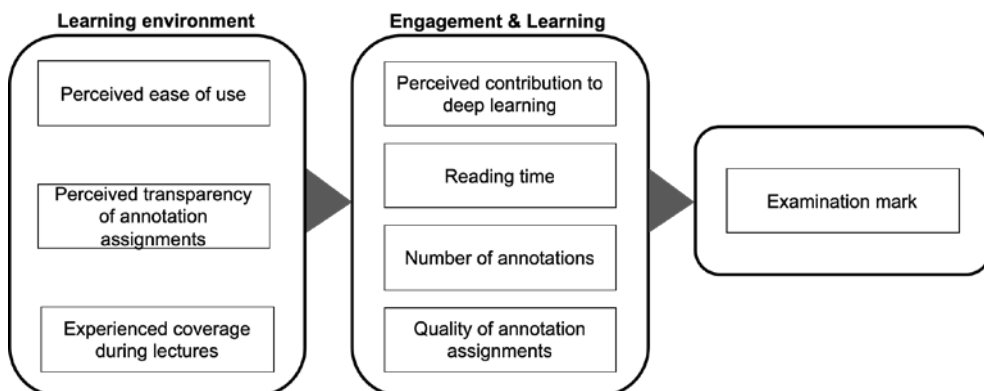
Figure 2. Framework for this study.

2. Method

The focus in this paper is twofold. Firstly, we studied which aspects of the use of Perusall in university courses contribute to students' perception of deep learning. We used a survey to collect data on student perceptions of the use of Perusall in their course. Secondly, we evaluated the impact of students' engagement in annotation assignments in Perusall (based on indicators derived from log data in Perusall) on students' examination performance.

2.1. Sample

This study is based on data from eight courses in which Perusall was used. In these courses teachers instructed students to place 5-7 annotations per reading assignment. For these eight courses we collected data among students about their experiences with the use of Perusall and their perception of its support to learning. For these same eight courses log data are available concerning the time students spent reading documents in Perusall, the number of annotations they put in Perusall and the grading of annotations in connection to the assignments.

2.2. Instruments

A structured questionnaire was used to collect data about students' experiences with the use of Perusall during the course. Students could give their opinion concerning several statements with four answer options ranging from completely disagree' to 'completely agree'. The statements were categorized in four categories (perceived ease of use, transparency of annotations, coverage of annotations and contribution of working in Perusall to deep learning) that form reliable scales. Mean item scores were computed for all four scales. The reliability of the scales varied between alpha .68 and .78. To allow students to elaborate on their experience with the use of Perusall the questionnaire contained an 'additional comments' open question at the end.

In this study we further used data about students' examination marks (which range between 1 and 10, 10 indicating the maximum mark), students' overall level of examination performance in their degree programme (indicated by their average mark on course units) and log data about the time spent reading documents associated with the annotation assignments (measured by computing the time during which students scrolled, annotated or clicked within a 2 minute time interval), the number of annotations and the assignments scores. These data were aggregated to allow for subsequent multilevel regression analyses. We computed z-scores on student's average examination marks and two engagement variables: the total reading time (expressed in units of hours) and the number of annotations students put in Perusall. As an indicator of the quality of students' annotation assignments we computed the percentage of the total number of points students could achieve after completion of all assignments.

2.3. Data collection and data preparation

Teachers of the courses received a request to participate in research about students'perceptions of the use of Perusall in their course. In six of the eight course units the participating teachers sent their students a link to an online questionnaire. In two courses teachers requested a paper questionnaire to hand to their students. Log data about student engagement were retrieved from the servers. The log data were used to compute

aggregate scores of student engagement. We computed students' total reading time, the number of annotations students they had put in Perusall and the percentage of the total score they could obtain by completing all annotation assignments.

2.4. Analysis

We assessed the impact of critical factors in the teaching setting and student engagement on deep learning and examination performance by means of multilevel analyses in which different random coefficients models were compared.

3. Findings

3.1. Student perceptions about critical factors to learning in Perusall

The descriptive survey data show that in most course units students were reasonably satisfied about the transparency of the annotation assignments but that only in two course units students' scale scores on the perceived ease of use scale indicate high degrees of satisfaction. In three of the eight course units students indicated the annotations were discussed thoroughly during lectures.

Table 1. Regression coefficients for the fixed effects of the factors transparency, ease of use and coverage of annotations in the course units on learning

Regression coefficients	Estimate	t	Sig.
Intercept	2.65	44.149	.00
Transparency of annotations	.21	2.92	.01
Ease of use of Perusall	.46	6.57	.00
Coverage in lectures	.21	3.56	.00

By means of a multilevel analysis we evaluated the relevance of the three critical factors for students perception of the contribution of Perusall to deep learning. As can be seen in table 1, all three factors have a significant impact on the perceived contribution of the annotation tool to students' learning. The amount of variance explained is 37%. Students' comments to the open question about their experiences with the use of Perusall revealed that many students had been unhappy with reading from a computer screen and expressed disconcern about the obligatory number of annotations. Especially students who started late reading the text before class expressed difficulty posting meaningful questions or answers to questions of other students.

3.2. Impact of student engagement on the final examination marks

In a second series of analyses we evaluated the relationship between student engagement in Perusall and both students' performance on the annotations and the final mark of the concluding examination. The first analysis revealed that differences in students' scores on the annotation assignments depend on both the total reading time and the total number of annotations, the total number of annotations having the largest impact. A further analysis of the impact of successful engagement in the annotation assignments on students' examination performance indicates that there is a positive relationship between the scores obtained on the annotation assignments during the course and the final examination mark. The results of this analysis are displayed in Table 2.

Table 2. Regression coefficients for the fixed effects of the factors assignments score and average examination mark

Regression coefficients	Estimate	t	Sig.
Intercept	5.79	13.59	.00
Assignments score (%)	.02	5.93	.00
Average examination mark	.62	4.76	.00

The regression coefficients in table 2 indicate that students' examination marks depend both on students' annotation assignments scores and (to a very high extent) on their average level of performance in other courses (average mark). In all courses in which Perusall was used the difference in examination mark between a student with the same average level of performance who has a score of 50 % and one who has a 100 % score on the assignments is approximately 1 point on a 1-10 grading scale. The size of the impact of the obtained assignment scores on students' examination marks is about the same in all courses as evidenced by the absence of a significant difference in chi-square between a multilevel model with and without a random regression coefficient. This multilevel model explains 22 percent of the variance of the examination grades.

4. Discussion

The results of this study indicate that the SA tool Perusall contributes to deep learning and that students who perform the annotation assignments as required obtain significantly higher examination marks. Perusall can thus be considered an effective learning tool for students. However, despite the positive outcomes of the pilots, his study also reveals that the contribution to students depth of learning depends on their perception of ease of use, transparency of annotation assignments and teachers' coverage of annotations. Students' complaints about the ease of use not only concern technical features of the tool such as

awkwardness of reading from the screen, printing or downloading documents but also practical issues such as having difficulty in adding meaningful annotations when other students had already added annotations to a text. In some course units students judged the transparency of assessment of their annotation tasks and the discussion of annotations in class by their teachers insufficient.

Given the expressed concerns above, teachers should carefully consider the choice of text documents, the nature of annotation assignments and the relevance of these assignments for students' preparation on final examinations. Teachers should take care that:

- selected texts and the group size allow for sufficient meaningful annotations.
- the nature of the assignments stimulate students to reply to each other's annotations.
- grading of annotations is clear and students receive examples of good annotations.
- students receive timely feedback on the content of their annotations.

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Teaching with emerging technologies in a STEM university math class

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Abstract

The aim of the research presented in this work is to investigate how innovative teaching formats, based on student-centred activities, may help first year university students to deal with the difficulties in the transition from the mathematics they are used to in high school, to the one they meet at university, which requires a significant shift to conceptual understanding, especially in Calculus courses. As part of this overarching goal, this presentation investigates the case of Taylor series, a topic that is taught in all calculus courses at university. This work shows the efficacy of a blended learning approach, highlighting the main difficulties concerning the deep understanding of functions by students. We discuss possible limitations, and we provide suggestions for best practices in university math classes.

Keywords: Blended learning; Calculus; First-year university mathematics; Formative assessment; Socrative; Taylor series.

1. Introduction

Calculus is one of the fundamental courses in all STEM programs, but even Engineering students deal with difficulties in mathematics, especially at the beginning of their studies (Gómez-Chacón, Griese, Rösken-Winter, & Gónzalez-Guillén, 2015). Many researches in Mathematics Education point out that difficulties are rooted in the differences between high school and university (Gueudet, 2008). Tall (2004) suggests to consider the transition as an "abstraction shock", since university mathematics adds a formal world to the mathematics encountered at school, and Clark and Lovric (2008) add that students live a leap from a focus on the procedural aspects to conceptual understanding that university mathematics entails.

Within calculus syllabus, topics like series, power series and Taylor series appear at surface level as procedural, but they require a deep conceptual understanding of function image, limits, infinite sum, the convergence radius, and approximation. The dual nature of the topic poses specific challenges to the students. The research *problematique* addressed in this work regards the way it is possible to support the move from procedural to conceptual approaches to mathematics in first-year calculus courses. A specific focus is on Taylor series, which requires a robust conceptual thinking without giving up procedural abilities.

In order to enhance conceptual learning, many scholars (e.g., Gamer and Gamer, 2001) have proven that student-directed learning promotes it more effectively if compared to traditional teacher-directed instruction. Blended learning formats are a way to encourage student-directed learning, both because the students are left alone, at home, in the process of meaning-making, and because in class they are involved in group work and discussions.

On the basis of these premises, the presentation unfolds as follows. Firstly, we recall the relevant aspects of Taylor series. Then, we describe how we designed and carried out a student-centred activity in a first-year calculus course for Building Engineering students at Politecnico di Milano. Finally, we briefly discuss the main findings.

2. Mathematical content: Taylor series expansion

The Taylor series expansion of a function $f(x)$ centred at a given value, $x=x_0$, is a power series in which each coefficient is related to a derivative of $f(x)$ with respect to x. Some common uses of Taylor series include numerical computations, evaluations of definite integrals and/or indeterminate limits, and approximations. The series is often truncated by choosing a finite upper limit for the summation on the basis of a certain criterion. The Maclaurin series is a special case, where x_0 is set to 0.

According to Smith, Thompson, and Mountcastle (2013), a small number of studies in Mathematics Education investigate students' understanding and use of Taylor series and in general the topic is not the main focus of the research, but only part of a broader project.

However, a dominant theme emerging from many articles is the difficulty of synthesising many previously learned calculus concepts to generate a robust understanding of Taylor series (see Smith, Thompson & Mountcastle, 2013). A specific focus is on graphical understanding of Taylor series. Interestingly, Habre (2009) found that visual reasoning of Taylor series convergence may be possible even for students with poor mathematical backgrounds and who may not be able to reason about convergence analytically. Hence, such an approach to Taylor series seems relevant for students who struggle with the conceptual approach of mathematics in STEM university course.

In the context of a physics course, Smith, Thompson, and Mountcastle (2013) investigate how students recall the relationship between the algebraic forms of Taylor series and the graph of the function. We share the same cognitive focus, but the context of our research is a first-year mathematics course, and our specific interest is on investigating how students create an understanding of this relationship the first time they encounter it.

3. Research methods

3.1. Data collection

In this presentation, we consider the data collected during a teaching activity on Taylor series. On the first day of the Calculus course, the students filled in an anonymous questionnaire, which allowed us to know their gender and the high school of provenience. Other three questions investigate their attitudes towards mathematics. The information provided by this questionnaire, which is shown in the next section, informed the design of the blended learning activity, which consisted of a homework assigned via email, and a lecture, which started with an activity with Socrative, an educational platform which allows delivering instant feedback poll in a large classroom. The results of our research regards the lecture.

3.2. Description of the sample

The students involved were 126, of which 54% males, and 11% had a weak mathematical background according to their high school of provenience, as shown in Table 1.

Table 1. Description of the sample.

LS=science and mathematics majors, TE=applied mathematics, HU=humanities majors.

Gender		High School type			
Male	Female	LS	TE	HU	Other
54%	46%	70.6%	18.3%	4.8%	6.3%

Source: by authors.

The first question on students' attitudes towards mathematics concerned how to deal with math problems - *What do you do when you deal with a difficult math problem?-* , the second question investigated students' attitudes towards mathematical problems (Figure 1), and the last question was related to the use of online resources to study mathematics (Figure 2).

The answers given by students to question 1 reveal that when they deal with a difficult mathematical problem the majority of them (38.1%) uses to refer back to a simpler problem, however many of them declare they use online resources, such as the web (23%) and social media (20.6%), while the 15.9% of students ask the teacher. Only 2.4% of them declares that they give up. From the second question, it emerges that students assign a procedural value to a mathematical problem, but they also think that a similar problem can be useful for deepening their mathematical knowledge (Figure 1). Finally, the answers to the last question show that forums and online videos are used for studying math (Figure 2).
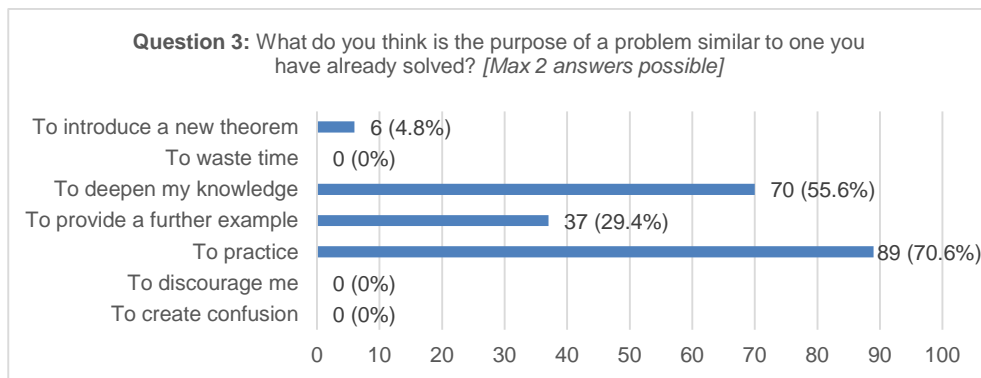
Figure 1. Students' answers to question 2. Source: authors
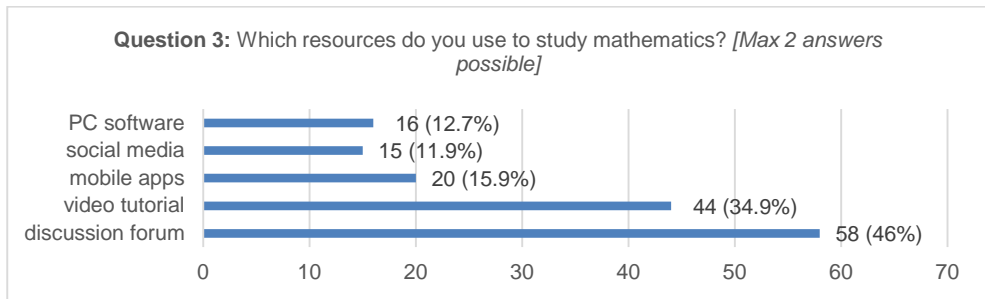
Figure 2. Students' answers to the question 3. Source: authors

From the questionnaire, we can infer that students involved in the project were confident with online resources and had a procedural view of mathematics.

3.3. Lesson design

In designing our lesson, we exploited the students' good acquaintance with web resources, but we also wanted to provoke a change in their approach to mathematics. To do so, we invited the students to engage in homework following these steps:

1. watch the video "Taylor Series"[1] as an introduction, which focuses explicitly on the relationship between algebraic and graphical representations of Taylor series;

2. read and study an online page[2], as a way to synthesise the previous video and to fix the ideas on the algebraic form of Taylor series;

3. given an example of a function, explore the graphical meaning of its Taylor series expansion through a Geogebra applet[3].

The goal of this activity is not only to introduce the concepts and to understand the relationship between the graphical and the algebraic approaches, but also to get sense of approximation of a function by means of Taylor series. An email was sent five days before the lecture and asked the students to work at home following the above steps. They had been informed that their work would have been the starting point of the lecture.

3.4. Geogebra activity as homework

The applet was designed using Geogebra online applet. The learning environment provides an interactive graph (shown in Figure 3), where students can explore the Taylor series providing the function and the centred point as inputs; the order *n* can be changed through a

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[1] The link to the english video is https://www.youtube.com/watch?v=3d6DsjIBzJ4

[2] The link to the Italian discussion forum is https://www.youmath.it/lezioni/analisi-matematica/derivate/537-come-sviluppare-una-funzione-in-serie-di-taylor.html

[3] The link to the Geogebra applet [Italian language] is https://www.geogebra.org/m/cbcz32vz

slider, and it is possible to visualise all the terms of the Taylor series. With the purpose of prompting students' thinking about the goal of the activity, namely the algebraic and graphical relationship and the function approximation, some suggestions are provided: 1) What happens when you increase the order? 2) The Taylor series allows you to approximate functions with polynomials. Do you agree? Why? 3) What happens if the function $f(x)$ is a polynomial? Make conjectures and try! 4) Consider the Taylor series of $f(x)=e^x$ at $x=1$. What is the maximum value of the error (namely the distance between the two graphs) within the interval [0,2] varying the order n of the series? And within the interval [-2,2]?

The goal of the homework was to prime the students to the concepts related to Taylor series and the questions were given in order to stimulate their reflection and elaboration of both mathematical theory and their exploration of the given example. The lecture started with a Socrative activity that, assigning similar questions and another example, serves multiple purposes: for example, fixing the student's ideas and letting misinterpretations and mistakes emerge.
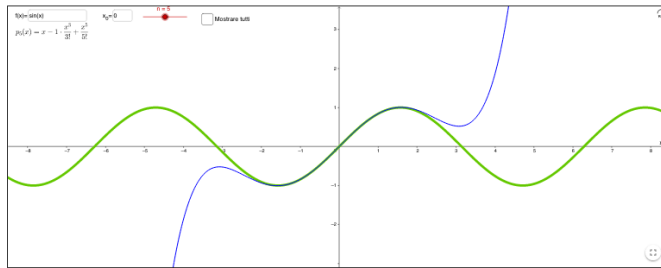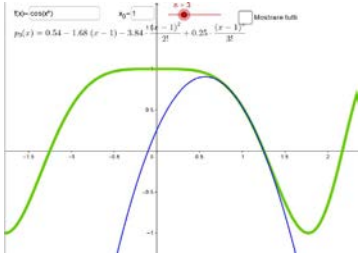
Figure 3. The Geogebra applet designed for the students' homework. Source: by authors from https://www.geogebra.org/m/cbcz32vz

3.5. Socrative activity in class

At the beginning of the lecture, the students were engaged in answering seven questions on Socrative reported in Table 2: questions 1 and 2 are multiple choice, questions 3 and 4 require to give a short answer, while the remaining three ones are of type true/false regarding the figure in question. Correct answers are given in brackets, for the reader's sake.

Table 2. Questions delivered through Socrative during the lecture.

1. The MacLaurin series of a function is…
    a. the Taylor series centred at $x=0$ [correct]
    b. the Taylor series up to order 10
    c. the Taylor series up to order 10 centred at $x=0$
    d. the function series with polynomials

2. The Taylor series of a function allows you to…
    a. compute the function's derivatives
    b. approximate the function with polynomials [correct]
    c. approximate the function as sum of its derivatives
    d. compute the function's value at certain points

3. Which is the Taylor series up to order 3 at $x=0$ of $f(x) = x^3 + 3x^2 + 10x-1$? [itself]

4. Which is the Taylor series up to order 5 at $x=10$ of $f(x) = x^3 + 3x^2 + 10x-1$? [itself]

5. The graph reports the Taylor series up to order 3 at $x=1$ of $f(x)=cos(x^2)$. [true]

6. The Taylor series up to order 3 at $x=1$ of $f(x)=cos(x^2)$ is a good approximation of $f(x)$ within the interval [0,1]. [false]

7. The Taylor series up to order 3 at $x=1$ of $f(x)=cos(x^2)$ approximates the function with an error below 1 with the interval [0,1]. [true]

4. Results from the Socrative activity

The number of students who participated in the Socrative activity is 98. The average number of correct answers is 5.45 over seven questions. Table 3 reports the percentages of correct answers to each question.

Table 3. Percentage of correct answers for each question

Q1	Q2	Q3	Q4	Q5	Q6	Q7
80.6%	95.9%	81.6%	42.9%	73.5%	87.8%	82.7%

The question Q1 is a mere verification of the definition provided in the online report, and the high percentage of correct answer shows that the students did the homework. We can notice that the huge majority of students replied correctly to question Q2. We can take this result as an indicator that the students watched the video assigned at home, but also that they understood the definition of the mathematical concept. The relatively high percentage of correct answers to question Q5 show that students explored at home the applet attentively. Questions Q6 and Q7 require to observe the graph and to comment on the approximation. From the answers to these questions we can infer that the activity with the applet at home helped them to figure out the concept of approximation of a given function by means of its Taylor series. The question Q3 and Q4 concern the property that the Taylor series of a polynomial function is the function itself, we highlight that some suggestions in the

homework were focused on this property. The different percentage of right answers to the two questions shed light on the difficulties of students with this topic. Looking at the answers in details, we can argue that the majority of students were not using the property but were explicitly computing the terms of the Taylor series of the polynomial. For instance, in the samples selected in Table 3 it is evident that students either computed the expansion of the polynomial function or tried to compute it. We stress that, even if the answers to Q3 given by the three students are formally correct, as well as the student 3's answer to Q4, they show that the students were not grasping the meaning of the activity prompted by question Q2.

Table 4. Example of answers to questions Q3 and Q4

Student	Answers to Q3	Answers to Q4
S1	$F(x)= -1+10x+3x^2+x^3$	I need more time
S2	$f(x)= -1+10x+6x^2/2! + 6x^3/3!$	$f(x)=-1+10(x-10)+6(x-10)^2/2!+6(x-10)^3/3!$
S3	$f(x)=x^3+3x^2+10x-1$	$f(x)=1399+370(x-10)+33(x-10)^2+(x-10)^3$

Moreover, the tutors who were present during the lecture reported that this point was the most discussed one with students. To support the property behind these questions, tutors computed the Taylor series using the definition like Student 3, but they simplified the result to explicitly obtain the given polynomial function. This proof, together with the use of the Geogebra applet, were the key elements to make the students aware of the meaning of a Taylor series and the relationship between the algebraic and the graphical representations.

5. Conclusions

To recall, the focus of our research is on how to support the students' conceptual understanding of Taylor series the first time they encounter this topic. In particular, we are interested in developing a deep understanding of the relationship between its algebraic and graphical representations. To this end, the results of our investigation reveal that the video and the text, respectively watched and read at home, reached the goal of supporting students' learning of Taylor series (and MacLaurin series). Paired with the homework activity with the Geogebra applet, the video and the text were also effective in enhancing the application of the concept to examples of functions, in a way that is manipulative, explorative and question-based. In fact, the student were successful in answering questions about other, new functions given in class. In this way, emergent technologies sustain the students' deep understanding of a challenging topic. True, a limitation of our findings is that the success of the activity depends on the students' willingness to engage in homework, which is not always the case (as it is outlined by researchers on Flipped Classroom). How to engage the class in home activities remains, thus, an open problem.

Another advantage of using the Geogebra applet at home revealed to be the possibility, for the tutor, to resort to it in class as a shared tool, which everybody knows and is able to use. Moreover, the in class activity with Socrative allowed the tutors to identify the weaknesses in the students' knowledge and to intervene timely and effectively. Socrative has been confirmed to be a tool for effective, in the moment, formative assessment.

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Technologies for attention to diversity: a bibliometric study

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Abstract

In these last decades, digital systems and playful dynamics have penetrated the inclusive education field, in some cases to attend the diversity of the classroom as a whole and, in others, to study in a specific way the use of technologies in students with special needs. About this topic, on the following pages we study the trends of the research carried out through a bibliometric analysis of the scientific production in the Scopus database, which includes an amount of 59 articles, published between 1999 and 2019. The results indicate an increase in the last years of the presence of scientific publications in journals in the field of Social Sciences. Furthermore, data show that the number of articles and the impact of these is scarce, that the predominant country in the publications is United States and that in the co-occurrence of the terms the agents involved in the process, technology and inclusive practices stand out as relevant issues, which implies the urgent need for digital teacher training.

Keywords: Technology; school; disabilities; inclusion.

1. Introduction

Information and communication technologies (ICT) have been firmly established in our society and their use is becoming more and more frequent in the educational field. From the political institutions, the use of technology in educational centers and, specifically, in classroom practices, has been included in legal regulations too (Area et al., 2014; San Martín, Peirats & Gallardo, 2014; Waliño, Peirats, Pessoa & Vidal, 2018). Numerous studies highlight the advantages of ICT, not only for neurotypical students, but also in supporting special needs students in an ordinary educational context (AEDENAEE, 2013), and they insist on the use of these tools to favor educational inclusion. We understand that inclusive education must "provide educational attention that favors the maximum possible the development of all students and the cohesion of all members of the community" (Spanish Ministry of Education, Culture and Sport, 2017, p.1) and that ICTs are tools capable of favoring it, with better and new learnings, pedagogical innovations, organizational changes, and especially, with the creation of asynchronous training opportunities (Cabero & Fernández, 2014).

In this sense, we consider that teacher training is necessary, both initial and permanent (Marín, Vidal, Peirats & San Martín, in press), to obtain the maximum potential of the technological devices, and that allow to implement innovative practices based on different methodological approaches, strategies and organizational models that contribute to creating inclusive environments and to offering opportunities for equity.

For all these reasons, the purpose of our work is to carry out a bibliometric analysis of papers published in Scopus database, without a temporal filter, to know the trends of scientific production on the use of technology in educational inclusion of people with disabilities, specifically, in the field of Social Sciences.

2. Method

For the analysis of the scientific activity carried out in educational inclusion of students with disabilities mediated by technology, a bibliometric analysis has been executed (Tomás-Gorriz and Tomás-Casterá, 2018). The focus has been on the texts available in Scopus database, because it has been considered several authors (Granda, Alonso, García, Solano, Jiménez & Aleixandre, 2013, Hernández, Sans, Jové & Reverter, 2016) as the most complete in terms of time coverage and number of titles by area. This has allowed us to know the status of the issue, the impact and the dissemination of studies, and successful experiences based on scientific evidence, specifically through a mesoanalysis (King, 1987) focused on Social Sciences field.

Terms used for the research in Scopus have been: *disabilities* & *inclusion* & *technology* & *school*, and all documents deposited until January 8th of 2019 have been included. The number of results obtained was 108, so it was considered more appropriate to limit it to *Open access* documents and to *Social Sciences* area, with these restrictions an amount of 59 documents were obtained. In addition, to analyse the topics worked and their representation, the program VosViewer (Van Eck & Waltman, 2011) was used and we have established, as categories of analysis, indicators of scientific productivity, collaboration and impact (Aleixandre et al., 2017). Furthermore, we have identified landmarks approached in these documents.

3. Results

Regarding scientific productivity, it is worth highlighting, first of all, the number of documents found, without a temporal filter nor limitation to a specific area of study. There are a total of 108 results published between 1999 and 2019; and our selection (59 documents) represents 54.6% of the total amount of researched published in Scopus in the last 20 years. As shown in Figure 1, the increase in the number of publications made in recent years is considerable and the trend is growing. Proof of this is that already, in the first week of 2019, there is a document in Scopus on this subject (Fage, Consel, Etchegoyhen, Amestoy, Bouvard, Mazon & Sauzéon, 2019).
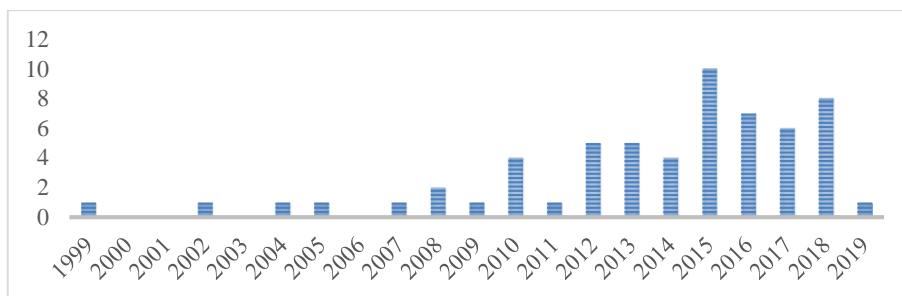
Figure 1. Frequency of Scopus publications. Source: Personal compilation.

Secondly, regarding the analysis of bibliometric size by country, United States stands out as the predominant place, followed by Brazil and United Kingdom. As shown in Figure 2, these three countries are responsible for more than half of the publications in this field. Spain belongs to the group of countries that have only one contribution (Afonso, Tadeu & Batanero, 2017), as well as Belgium, Canada, China or Denmark; that's why it does not appear in the figure; we have only represented the countries more than two publications.
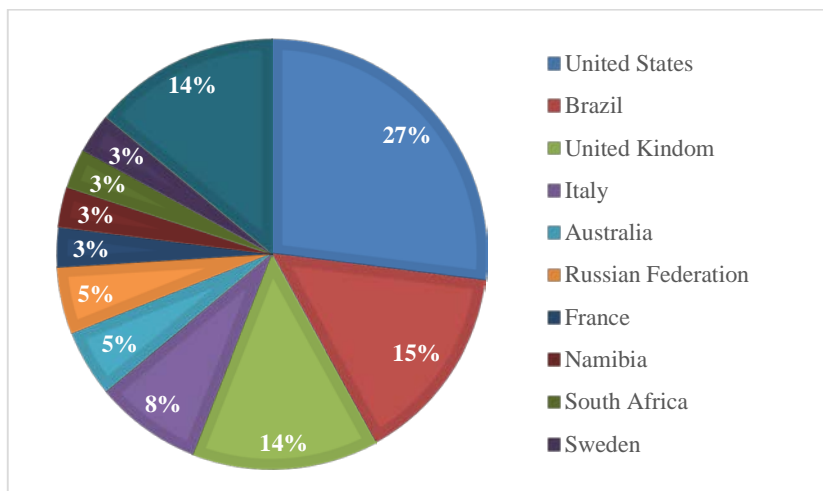
Figure 2. Publications per country. Source: Personal compilation.

According to collaboration, Table 1 presents the data regarding the number of authors who sign each document. It stands out that 75% of the texts are signed by two or more authors, so the collaboration index is high and the most usual are papers signed by two authors (37%). Seven is the maximum number of signatory authors registered, as in the recent article by Slemmons, Anyanwu, Hames, Grabski, Mlsna, Simkins & Cook (2018).

Table 1. Number of signatories per document.

Number of authors	%
1	25
2	37
3	14
4	8
5	8
6 or more	8

Source: Personal compilation.

In regard to the impact, Table 2 shows the number of citations received for the analysed documents, as we can see there are great differences between them. It stands out that more than 30% of the documents do not have any citations and that it is independent of the year of publication. Half of the documents have less than 10 citations and among the most cited

documents, an article on ASD (Wehman, Schall, Carr, Targett, West & Cifu, 2014) and three reviews (Istenic & Bagon, 2014; Alquraini, 2012) are found. Within these reviews, the only one with more than 100 citations is located, in which Ferguson (2008) analyses the features of inclusion from an international perspective.

Table 2. Number of citations.

Citations received	%
None	34
1 - 10	51
10 - 20	8
21 - 30	3
31 – 40	2
More tan 100	2

Source: Scopus. Personal compilation.

Finally, in terms of the main areas of research in this field, the existence of three clusters stands out, which revolve around the subjects implicated and their limitations (*student, child, person, disability, need, teacher*), technology (*technology, assistive technology, accessibility*) and inclusive practice (*social inclusion, support, strategy, inclusive education, barrier*) (Figure 3).
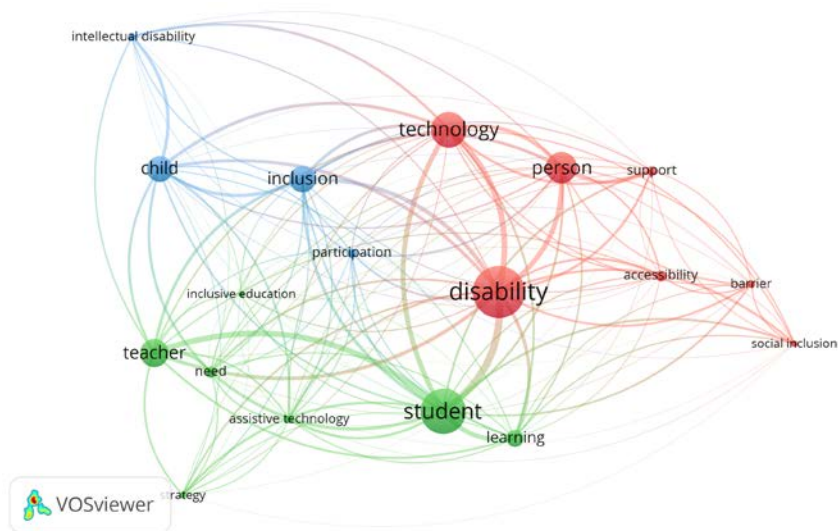
Figure 3. Co-ocurrences map.

4. Discussion

The aim of the study was to analyse trends in research on technologies for attention to educational diversity in the field of Social Sciences. For this, a bibliometric analysis of the scientific production deposited in the Scopus database was carried out. In which a selection of indicators of scientific productivity, collaboration and impact, as well as the co-occurrence of prevailing terms have been studied in the documents.

Firstly, the results published and available in the Scopus database indicate that interest and effort by the study on the subject has been increasing in recent times, so much that in the first week of 2019 a document was already registered. In addition, we emphasize that, although studies are also reflected from other areas of knowledge, such as Medicine, Computer Science, Engineering and Psychology, the predominant area is the Social Sciencies, English as the prevailing language (followed by Portuguese), and United States (followed by Brazil and United Kingdom) the overriding country.

Secondly, analysing the characteristics of co-authorship and collaboration, through the number of signatories, it should be noted that most of the documents were signed by two or more authors, which indicates that the collaboration structures and networks in the scientific community, on the subject, are relatively high.

If we look at the impact, it is noteworthy that a high percentage of the works did not get any citations and that more than half of the documents have less than 10, which implies that the impact of most of the studies analysed has been limited. However, it is also remarkable that one of the papers, which studied international tendencies regarding the challenge of attending to the class as a whole and, at the same time, the individuality of each one of the students through technology, was cited 114 times .

Finally, regarding to the main research lines, data from this study allow us to identify the existence of three large clusters: the subjects involved (*child, adolescent, student*), technology (*ICT, technology, assistive technology, information and communication*) and inclusive practices (*teaching, inclusion, disabilities, special education*) as fundamental elements in the educational process.

The process of integrating technologies into teaching-learning practices in the different educational modalities is a reality, and also in inclusive school (Al-Harthi & Emam, 2018; Young & Courtad, 2016). In this situation, the initial training of future professionals in education (Barber, 2018, Hall & Theron, 2016) is essential. There are numerous studies suggesting that teachers have not received a true qualification throughout their training, to incorporate the technologies to his professional activity (Carruba, 2016; Fiorini & Manzini, 2016). They would also need, according to others (Lyons & Tredwell, 2015, O'Rouke, 2015), the implementation, by the administrations of compulsory models about the use of

technologies for inclusive education. In conclusion, as expected, most of publications conclude that there are many possibilities in technologies as an activating element of other strategies that establishes a bridge between students and their learning, and that increases their motivation, interest and performance (Istenic & Bagon, 2014; Young & Courtad, 2016) in a context such as the current one in which digitization covers all areas of society. However, and finally, we ask ourselves if educational institutions are trained for the challenges involved in the coalescence of technology at inclusive process. As future lines, we should think about the impact of high or low number of publications on educational diversity; does it represents the educational reality of inclusion? Are related low number of publications with disabled students with fewer educational resources? Or are school and research going different ways?

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Implementation of Computer Assisted Experimental Work in Analytical Chemistry Laboratory Teaching

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Abstract

Computer-Assisted Experimental Work (CAEW) consists in the incorporation of computer-connected apparatus in the laboratory. This is a new insight into teaching of Classical Analytical Chemical, wherein the experiments are usually manually conducted. However, it does not represent a complete break with traditional methodology, as the design and goal of the experiment are essentially the same.

In this work, we present the implementation of CAEW to a practical included in the Laboratory part of "Analytical Chemistry IV", taught at the fourth anademic year of the Degree in Chemistry: "Potentiometric titration of a mixture of iodure and chlorure with silver". Three couples of students used an Ag-ion selective electrode connected to a computer, while the other three couples employed a digital one. The results were comparable, though the computer-assisted method provided significant improvements, like: the students get familiar with new technologies at an accessible level, the titration can be visually followed on the screen via the titration curve, the calculations are automatically performed, it allows the detection of experimental and registration mistakes, it avoids errors caused by the transcription and processing of the data,and the students achieve their practical disposing of the final results, and all their work corrected by the teacher.

Keywords: Chemistry; Computer-assisted; Precipitation; Teaching; Titration; University.

1. Introduction

This work has been developed in teaching laboratories at the Universitat Jaume I (UJI) in collaboration with a secondary school of Vila-real, IES Vicente Castell. The IES provided the software DataStudio (ref. CI-6859C), the Ag-ion selective electrode (ref.2104) and the adapter "USB-Link" (Ref.PS-2100) and their respective hardware and software. They were made by PASCO (http://www.pasco.com) and marketed by PRODEL teaching equipment (http://www.prodel.es).

The tested laboratory practical was: "Potentiometric titration of a mixture of iodure and chlorure with silver" (Sawyer & Heneiman, 2002), which is included in the Laboratory part of the subject "Analytical Chemistry IV" (QU927), taught at the fourth (last) anademic year of the Degree in Chemistry at the University Jaume I (UJI Virtual Classroom https://aulavirtual.uji.es/?lang=es; Esteve-Romero, 2006).

The students had to conduct the precipitation titration in aqueous media of a mixture of iodure and chlorure with silver(I). The titration reactions were the successive precipitation of both anions with Ag^+ (stoichiometry 1:1), first the iodure and later the chlorure. The end point was detected by the monitoring of the potential measured by an Ag-ion selective electrode (ISE) *v.s.* titrant volume (Harvey, 2016). The goal of the practical was to quantify iodure and chlorure in the sample, and to calculate the Kps of their respective precipitates with silver. The practical belongs to Classical Analytical Chemistry. This branch of the Analytical Chemistry aims to identify/quantify/determine the physico-chemical properties of the analytes by means of their reactivity. It uses traditional laboratory glassware and apparatus, and the experiments are manually carried out (Monferrer-Pons & Esteve-Romero, 1996; Skoog *et al.*, 2013). The incorporation of a computer-connected device represent a significant and revolutionary innovation in this area (Esteve-Romero & Carda-Broch, 1998; Gil-Agustí *et al.*, 2009a). This fits with the guidelines of the European Higher Education Area (EHEA), which stated that the student must be at the center of the teaching-learing process. That means modifications leading to an increase of the students background should be developed (Gil-Agustí *et al.*, 2009b).

The aim of this the was to compare the classical and CAEW approaches (considering the entire execution of the practical, the data registration and processing, time taken to achieve the practical and the post-practical work, as well as the analytical quality of the results), and to establish their respective advantages and drawbacks.

2. Experimental procedure

The practical was conducted by pairs of students, as usual in the Analytical Chemistry Laboratory. The students perform the titration following the Good Laboratory Practices

(GLP) guidelines (Gil-Agustí *et al.*, 2009c). Half of the students performed the practical using an Ag-ISE connected to a computer (couples CAEW-1; 2 and 3), while the other ones utilized a digital one (control couple-1; 2 and 3). Apart from this, the practical was conducted as the same way. Only the work performed by the CAEW couples is here described.

The titrant was a solution of $AgNO_3$ 0.9994 M, while the sample was a solution of I^- and Cl^- at unknown concentrations, acidified with drops of HNO_3 and salt-buffered with $Ba(NO_3)_2$. The Ag-ISE was cleaned by polishing, in order to remove low-soluble silver precipitates adsorbed on the surface, remove fissures and homogeneize it (Harvey, 2016).

2.1. Software configuration

Once opened the DataStudio software and connected the Ag-ISE using the UBS-link to a computer's USB port, a window displayed a plot of potential vs. titrant volume and the axis configuration.

The next step required the performing of some simple initial operations for the software configuration. a) Set the manual entry of the volume. The selection of the option "Setup and sampling options" opened the window for manual input of a magnitude of the x-axis. The name (Volum Ag), and the unity (mL) and the associated precision (mL) of the titrant solution had to be introduced. Once at this point, return to the initial screen and the software was already ready.

2.2. Titration process

Firstly, the titrant was introduced in the buret, and then an aliquot of the sample (the titrand) was introduced in the erlenmeyer flask, which was placed under the buret. Secondly, the Ag-ISE was introduced in the titrand solution. Afterwards, the titration could begin. As in a traditional titration, several volumes (mL) were added from the buret. Before the addition of the first mL, the start button, appearing on the top left of the scree had to be pressed. An option showed up, where the titrating volume was asked. After pusing 0, the first pair of data was taken. Every time the titrant was added and the solution homogenized, the button "Start" was pushed again to introduce the volume added. In this way, the plot of E vs. titrating volume was constructed. The titrant was added in 0.5-mL steps as a general rule, and by 0.1-mL steps when close to the end point. The titration was finished when the addition of silver solution does not significantly increase the signal, far from the second end point.

For the control group, the titration was conducted alike, but the experimental data of volume and potential manually were manually recorded.

2.3. End point determination

The titration end points were determined by the first and the second derivative, as well as the Grau methods (Harris, 2007). The software itself drew the corresponding plots, and calculated the end point volume and potential.

2.4. Calculation of the Kps

The potential, at any point of the titration curve, follows the equation (Harris, 2007):

$$E = E^0 + 0.059 \log [Ag^+] \tag{1}$$

To calculate E^0, we have to measure the potential far from the end point, after the total precipitation of the analytes. In this region, there is a large excess of free Ag^+ in the solution, and its concentration can be easily calculated by the following equation:

$$n(Ag^+)\text{consumed by the titration} = n(I^-)_0 + n(Cl^-)_0 + n(Ag^+)\text{free} \tag{2}$$

Once $[Ag^+]$ known, we can calculate E^0.

For both anions, the precipitation equilibria product ($Kps = [Ag^+][X^-]$) is valid as long as AgX, X^- and Ag^+ coexist in the solution, then in any point of the curve. Additionally, at the equivalence point, we have $[Ag^+] = [X^-]$, then $Kps = [Ag^+]^2$.

We need to know the potential at the first and second end point for I^- and Cl^-, respectively, and substitute in equation (1). Then we will calculate $[Ag^+]$ and Kps.

3. Results

The students did not have any problem to understand the use of the software and hardware. Indeed, they are highly-skilled (they are close to the completition of the degree) and its manipulation is very simple. In fact,the experimental work conducted by the students using CAEW and classical procedure was essentially the same.

One of the high advantages that EXAO introduces is the possibility of monitoring step by step the titration, by the configuration of the precipitation titration curve. In the traditional methods, the use of a digital Ag-ISE to follow a potentiometric titration requires that the student manually register the data, transcribe them to a separate office spreadsheet and then build a graph. If the titration is followed by a change in the colour of a chemical indicator, there is even no possibility to construct a plot.

EXAO also introduced the option of a direct calculation of the end point volume and potential using either the first or second derivative, or the Grau methods. This enabled the students to achieve the objectives of the practical: the calculation of the concentration of I^- and Cl^- and the Kps of AgI and AgCl. In the traditional approach, this was made by

introducing the formula and manipulating the data on an office spreadsheet, thus increasing the risk of processing errors.

Only the results obtained by the couple of students using EXAO are shown. Figure 1 shows the raw titration curve. Figure 2; 3 and 4 show the curves obtained by applying the first and second derivative, and the Grau methods, respectively.
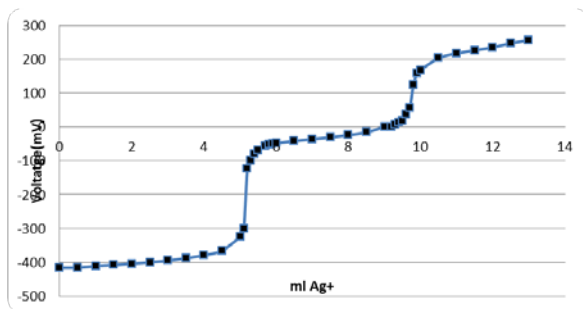
Figure 1. Titration curve.
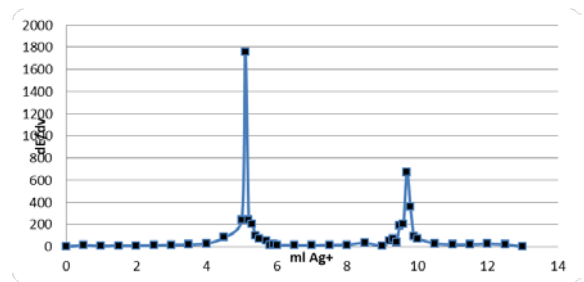
Figure 2. Curve obtained by the first derivative method.
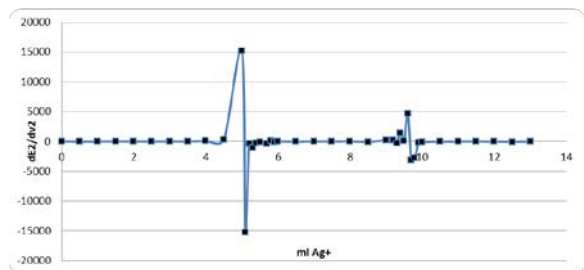
Figure 3. Curve obtained by the second derivative method.
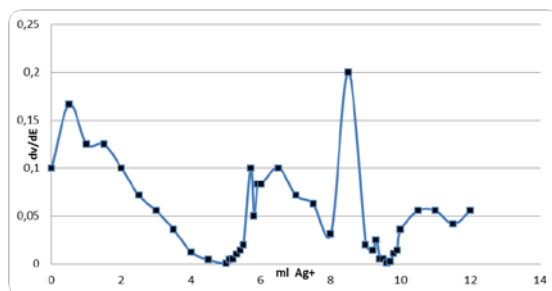
Figure 4. Curve obtained by the Grau method.

Regardless of the method used, the end point volumes were 5.1 mL and 9.7 mL. The first end point correspond to iodure and the second one to chlorure, as AgI is more unsoluble than AgCl. The theoretical value of pKps(AgCl) and pKps(AgI) were 10.2 and 22.2, respectively; close enough to the tabulated values (10.7 and 22.0). The control couples obtained similar results.

All the students took similar time to achieve the practical. At the end of the session, the CAEW group have finished all the calculations and disposed of the results, automatically provided by the sotware. Besides, they were able to have their work corrected by the teacher, and could discuss the obtained values with him. The control couples only had the raw data; and had to perform their calculations after the laboratory session, by transcribing the hand-recordered data to a separate office spreadsheet.

Each couple were in the risk of making the following mistakes during the development of the practical and the elaboration of the post-pastical work was as follows:

- CAEW couples: experimental and recording of the titrant volume (the potential values were automatically collected by the software).

- Control couples: experimental, registration of both titration volume and potential, transcription and processing.

However, the CAEW couples were able to notice the errors during the laboratory session, in time to correct them, unlike the control couples.

4. Conclusions

The results obtained using CAEW and the tratidional method were similar in analytical quality. The use of CAEW exhibits the following advantages:

- It introduces the use of new technologies to students.

- It was not a complete break with traditional methods because the classical experiments were still working. Therefore, the students can easily adapt to it and interpret the results.

- It used software that permits to understand, visualize and process the experimental data, during the conduction of the practical. Besides, it automatically provided the main analytical parameters of the titration: end point volume and potential.

- Experimental and recording errors can be immediately noticed and corrected.

- Transcription or processing errors can hardly occur.

- All the post-practical work can be performed during the laboratory session, under the supervision of the teacher.

However, we must point the following drawback:

- Each couple of students must have a laptop or PC in the laboratory, thus increasing the cost of the practical.

The introduction of this methodology would ameliorate the teaching-learning process at the Chemical Laboratory, and then improve the background of the students. Therefore, this is highly interesting for a subject designed following the guidelines of the European Higher Edcation Area, which stated that the student must be at the center of the education system (Gil-Agustí *et al.*, 2009b).

Acknowledgements

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The Factors Affecting University Retention/ Attrition by Big Data Analytics

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Abstract

Using the enrollment data at the Faculty of Business (FOB) in the University of New Brunswick, Saint John (UNBSJ), we perform the big data analytics to examine the cause of attrition: a) the existence of potential risk groups and b) the potential courses, which can be the predictors of student attrition in the first few years in the university. The logistic regression was used to find the potential predictors for students' retention in UNBSJ, and the cluster analysis also suggests the existence of inherently high-risk groups in UNBSJ students. By providing institutional support for the high-risk groups to successfully complete the program, the retention rate could be improved..

Keywords: University Retention / Attrition; Big Data Analytics; Logistic Regression; Cluster Analysis; Identifying High-Risk Group.

1. Introduction

Student retention, which is keeping students until graduation, is one of the strategic focuses in the Canadian University. In Canada, the average dropout (attrition) rate after first year in University was 14% and the overall post-secondary dropout rate was about 16 % (Freeman, 2009)[1]. According to Bean's (1980) review of the previous retention rates, one research reported the median of 50% loss of students in 4 years in the U.S. and another research showed 41.5% attrition in 1966, and the similar rates were shown in Canada, England and Australia.

There are various dropout reasons: to transfer to other institutions or programs, the financial reasons, RTW (Request to Withdrawal) due to the low GPA (Grade Point Average), the lack of interest or finding the limitation to continue the desired major. Survey says that the dropout students were struggling with meeting deadlines, academic performance and study behaviour in their first year, and many of them thought of leaving in their first year (Freeman, 2009). The same article also mentioned that the less preparedness in first-year students continues more strongly in the internet-oriented age.

While there are numerous studies that examined the causes of the dropout in post-secondary institutes, their main focuses are on the characteristics of the dropout students and the perceptions of the dropout students about the institutional support such as commitment, quality and the university governance styles (Bean, 1980; Tinto, 2000). Instead of attributing the dropouts to the personal characteristics and/or institutional systematic problems, our research focuses on identifying the key courses, which can serve as predictors to student's retention.

In order to find the predictor courses in the University of New Brunswick, Saint John (UNBSJ), we collect the demographic and enrollment data for 7 years and the graduation list in the Faculty of Business (FOB) from the Registrar's office. Our assumption is that the failure or poor performance in a certain course(s) makes students frustrated and results in their dropping out.

Our research questions are (a) What courses in the first year can be a predictor of students' attrition after the first year? and (b) Are there any groups requiring a special attention in the first year?

After figuring out key courses and special groups in need, Gwinnett Education Division developed the support program and made a big success in their program (LaValle *et al*.,

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[1] The post-secondary education includes University, College, Polytechnic, Apprenticeships and Private Vocational Colleges.

2011). We expect the similar effect in UNBSJ and wish to implement the support programs for the vulnerable groups to succeed in key courses and untimately to graduate.

2. Literature Review

Gwinnett County, GA, is one of the successful anecdotes that the analytics using the big data increases the effectiveness of education. After allocating more resources to help the students in need in the focused areas predicted by analytics, the academic performance and the graduation rate were remarkably improved. (LaValle *et al*., 2011)

There have been studies about the university retention for the last half century. The theories behind the university attrition or dropout were well discussed in Bean (1980), Braxton (Editor: 2000) and Tinto (2012). Bean (1980) was cited widely because he performed the empirical research about his conceptual and causal model for student attrition. He found the potential causes for attrition: For female students, three variables were statistically significant in explaining dropout: institutional commitment (-.47), institutional quality (-.11), and routinization (.10). The numbers in the parenthesis are the regression coefficients to the dependent variable "dropout". For male students, four variables were significant: institutional commitment (-.29), routinization (.15), satisfaction (.14), and communication (rules) (-.13). The common causes are the low institutional commitment (or loyalty toward organizational membership) and the high routinization (or repetitive role view about students). But, there are some gender differences about dropouts. From the path analysis, he concluded that institutional quality and opportunity (transfer) were the two most important variables influencing institutional commitment.

Tinto (1975) synthesized the previous research and revised a theoretical model later (1993). He explains the effective retention program as the utmost commitment to all their students and the development of supportive social and educational communities. Especially, he emphasizes the first year as the transition period to college in both social and academic structure. For the smooth transition, the university needs to assist the first year students including monitoring and early warning, and counseling and advising. Tinto (2000, 2012) again wrote the book about refining and rethinking of the college education. He emphasizes the first year experience again and he points to the classroom as the center of student education and life, and therefore the primary target for institutional action.

As a matter of fact, many white papers are available about the admission process (that is, selection of students) and how to improve the enrollment rate from admitted students. For instance, Henschen (2013) and Information Builders (2013) report that Taylor University in Indiana analyzed the 12 years student data and found the strategy to maintain 85 % student retention rate.

3. Methodology

3.1. General procedure

The data for the Faculty of Business in UNBSJ was collected directly from the Registrar's office. The data includes the following information for each semester from 2006 to 2012:

- Personal: Student ID, Gender, Birth Date
- Academic: Degree, Major, Load (Fulltime?), Current Year of program
- Demographic: Citizenship Country and Province, last High School
- Credit-related: CGPA (Cumulative Grade Point Average), Registered Credit Hours, Transferred credits
- Course-related: Course ID, Course level, Credit hours, Final Grade

After several steps of refining the data, we filtered out 7 key courses with at least 90 data. For 483 students remained after removing students who didn't take those 7 courses[2], we applied the retention/attrition result to each student. Using this database, we perform the Correlation Analyiss and the Logistic Analysis for those courses to figure out the potential impacting courses and do the Cluster Analysis to find the potential subgroups in each course.

3.2. (Binary) Logistic Regression

The logistic regression is a tool to analyze the binary dependent variable (p) with respect to the continuous (interval) independent variables. The multiple regression predicts the success probability of p in [0,1] range. To guarantee the predicted value of p in [0,1], we need to modify the regression formula as follows (it is also called a sigmoid curve): $p = e^{(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)} / [1 + e^{(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)}]$.

The cut-off value, c, is used to classify the observation into 0 or 1. If the predicted value from an observation is above c, it would be classified to 1. Otherwise, it would be 0. The cut-off value is determined to maximize the overall accuracy of prediction. In our analysis, the retention status is a dependent variable, and course GPA taken during year 1 and 2 and other demographic data are independent variables (or predictors). We will divide valid dataset into the model (70%) and evaluation (30%) to find the predication power, as mostly used in big data analytics.

3.3. Cluster Analysis

This study also uses to figure out the similar subgroups (called a cluster) in the students taking the same course(s). The purpose of this cluster analysis is to find the subgroup in high risk

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[2] The course number was modified to shield the confidentiality.

and implement to a support program to help those student groups. The hierarchical cluster also helps to find the important variables to cluster the data into groups.

4. Results

4.1. Correlation Analysis

For all the data including RTW students, we performed three diffrent correlation analyses: (a) Retension or CGPA with key demographic variables, (b) CGPA vs. key courses, and (c) correlations among course GPAs. Those results are summarized in Table 1(a). Note that the CGPA is the major factor to associate with all courses and with most of demographic variables.

In order to figure out the relationship among variables and courses for retained students only, we performed similar analysis after excluding the RTW students, whose results are in Table 1(b). Since RTW is for less than 2.0 CGPA, we eliminate 111 (or 23%) of those students and have a reduced data set (n = 372) at this stage. Although the correlations of Retention to CGPA or NoMajor are reduced from the value at the previous stage, they are still significant at 0.01 level. The variable "Male" and "International" become more important to Retention.

Table 1. Results from Correlation Analysis

(a) Data including RTW students (n = 483)

	CGPA	NoMajor	International	FullTime	Male	Trans Credit	StartAge
Retention	.599**	-.385**	0.032	-0.054	-0.073	.205**	.097*
CGPA		-.308**	-.129**	-0.067	-.221**	.250**	.220**

	BA-131	BA-170	BA-160	BA-260	BA-270	BA-222	BA-231
CGPA	.711**	.607**	.570**	.583**	.562**	.706**	.611**

	BA-131	BA-170	BA-160	BA-260	BA-270	BA-222	BA-231
BA-131	1						
BA-170	.551**	1					
BA-160	.451**	0.103	1				
BA-260	.566**	.395**	0.135	1			
BA-270	.573**	.547**	0.327	.501**	1		
BA-222	.630**	.787**	0.503	.619**	.582**	1	
BA-231	.577**	.421**	.587*	.723**	.424**	.638**	1

(b) Data without RTW students (n = 372)

	CGPA	NoMajor	International	FullTime	Male	Trans Credit	StartAge
Retention	.204**	-.280**	.115*	0.024	.103*	.108*	-0.006
CGPA	1	-.152**	-.147**	-0.026	-.161**	.229**	.209**

	BA-131	BA-170	BA-160	BA-260	BA-270	BA-222	BA-231
CGPA	.686**	.585**	.536**	.613**	.496**	.766**	.657**

(** 0.01, * 0.05 statistical significance)

The CGPA is still very clasely related to the key courses. However, The logistics analysis and cluster analysis are not useful tools in the stage of no RTW students, because the sample is already filtered only to passed students, and thus the retention rate is all high.

4.2. Logistic Analysis to predict retention (with including RTW students)

Because of the dominant effect of CGPA for all models, we have a difficulty in analyzing the effect of each course GPA. As a matter of fact, the CGPA has the highest correlation with retention and it absorbs the effect of each course on retention. Hence, we need to remove the variable "CGPA" to see the effect of each course. The results are shown in Table 2.

Note that the "NoMajor" variable is now important because this variable is another proxy for CGPA, but it is better to keep the "categorical" variable in the model, instead of numerical variable "CGPA". Compared to other course models, the one with "CGPA" shows the better prediction power and the higher coefficient of GPA part.

The coefficients of logistic regression equation are found from $p = \frac{e^{(\beta_0+\beta_1 x_1+\beta_2 x_2+\cdots+\beta_k x_k)}}{1+e^{(\beta_0+\beta_1 x_1+\beta_2 x_2+\cdots+\beta_k x_k)}}$.

For example of BA-131, logit(p) $= ln\left(\frac{p}{1-p}\right) =$ - 0.126 + 0.866 * [Course_GPA] + 1.582 * [International] - 2.665 * [NoMajor] + 0.003 * [TransCredit]. The risky students group here is students with low Course_GPA, domestic and no_major students. While the international student with Course_GPA=3.0 having a "Major" have a retention probability (that is, *p*) of 98.3%, a domestic student with Course_GPA=2.3 and "No Major" have a 31.0%. Although the CGPA is critical part of retention from correlation analysis, a new finding from this analysis is the importance of "Declaring Major" in early stage of students' university life. Hence, we can find the risk group from the analyzed coefficient for each course.

Table 2. Logistic Analysis (with including RTW students)

Model	BA-131	BA-170	BA-160	BA-260	BA-270	BA-222	BA-231
Constant	-0.126	0.187	-2.21	0.129	19.406	-4.978 *	16.79
Course GPA	0.866 **	0.559 **	1.449 **	0.913 **	0.607 *	2.084 **	
FullTime						1.832 *	
International	1.582 **	1.297 **	1.58 **	1.888 **		2.927 **	
Male							
NoMajor	-2.665 **	-2.485 **	-2.503 **	-2.77 *	-20.311	-3.195 *	-20.816
StartAge							0.216 *
TransCredit	0.03	0.03 **				0.042 *	-0.035
n	209	189	171	138	111	101	98
% correct selected	81.4	74.6	75.8	81.4	79	82.7	76.5
% correct unselected	75	72.9	69.8	73.2	76.7	80.8	50

Tabla 3. Cluster Analysis (with including RTW students)

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Size	0.288	0.244	0.238	0.23
Description	International students with low CGPA	Domestic students with (very) low CGPA	Domestic students with high CGPA, no-major	students with high CGPA, and major
Have major	0.014	0	0	1
International	1	0	0.009	0.234
CGPA	2.26	1.91	3.02	2.99
StartAge	22.5	21	24.9	22.8
Retention	0.568	0	0.965	0.973

4.3. Cluster Analysis (with including RTW students)

The high-risk group is also identified by the cluster analysis with all the demographic data and CGPA without specific course GPA's. Table 3 shows four different groups, which can be explained in the decision tree as Figure 1.

We also did the cluster analysis for each course, and somewhat different sub-groups were verified, with respect to different thresholds of NoMajor, International, FullTime and Retention. Although the detailed group information for each course was not presented in this paper, we can figure the high-risk groups out from students population, and develop the supportive program to help those groups.

CGPA > 2.3 → Cluster 3 & 4 (46.8%): Retention rate = 97% (Cluster 4 has a major, but Cluster 3 does not.)

CGPA < 2.3, International → Cluster 1 (28.8%): Retention rate = 57%

CGPA < 2.3, Domestic → Cluster 2 (24.4%): Retention rate = 0 %
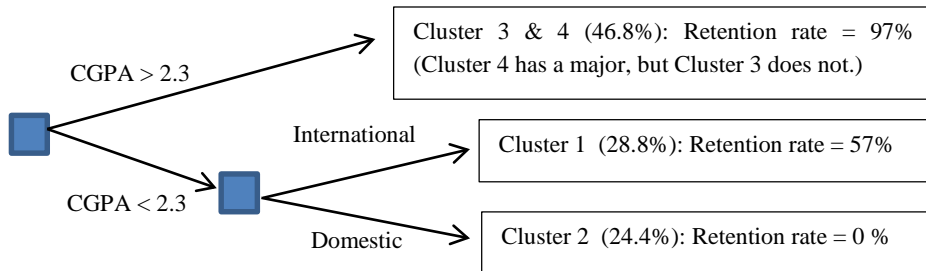
Figure 1. Decision Tree from Cluster Analysis

5. Conclusions

From the logistic regression and the cluster analysis using the FOB enrollment data, we figure out the predictor for retention. We expected to find the courses to predict the student's retention, but the results showed no valid courses to predict. We found one course, BA170, with 10% significance level, but the power to predict is now doubtful due to the high correlation with CGPA. Hence, we perform the logistic regression analysis without CGPA, which shows the importance of declaring his/her major in early stage of university life.

From the cluster analysis, we successfully identify the high-risk groups: the low GPA domestic students directly from high school, and the low GPA international students. By carefully designing the sequence of courses, we may find the right time to help those high-risk students develop their potential abilities to continue their university studies.

It may be worthwhile to say the difference between dropouts of Bean (1980) and UNBSJ case: whether it is voluntary dropouts or RTW (Request to Withdraw) due to the low CGPA: in other words, attitude or study habits. However, by reinforcing the institutional effort, it may be possible to motivate students study hard and to increase their CGPA from their first or second year in university. By focusing on helping the students of CGPA between 1.6 and

2.4 (out of 4.3 scale) and on setting up the retention target for specific CGPA groups, we can improve the retention rate by 6%.

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'Centering' Teaching Excellence in Higher Education

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Abstract

This paper explores the complexity of 'teaching excellence' (Kreber, 2002) in contemporary higher education. It describes how a university academic, who has been the recipient of numerous teaching awards, questions if they really are an 'excellent teacher' and if their student-centered philosophy is sustainable. An analysis of data related to teaching and learning effectiveness over a seven year period highlights a significant weakness in how the academic approached the teaching of undergraduate students. This had a subsequent negative effect on several levels. The paper concludes by describing the merits of academics 'centering' themselves between the corporate university and the needs of students in striving for 'teaching excellence'.

Keywords: teaching; learning; university; excellence; corporatization; philosophy.

1. Introduction

Historically, university academics were afforded time and space to shape their research and scholarship endeavors (Berg & Seeber, 2016). In modern times, universities are competing in a fast-paced global market (Altbach, 2007) in which governance by numbers (Ball, 2015) and outcomes-based educational accountability (Beauchamp et al., 2016) dominate. The 'corporatization of the contemporary university' (Berg & Seeber, 2016) means that almost all facets of operating a successful and competitive institution are now quantifiable. Academics are increasingly expected to attend to the governance of their own institutions by ensuring that the inner core of the corporate shell upholds traditional values around learning, scholarship, and service (Steck, 2003). This paper examines the following research question; how effective and sustainable is a student-centered teaching philosophy when teaching large class groups within a research intensive university?

1.1. Teacher and Mentor

On commencing my tenure as a junior academic, I had a very utopian view of how I wanted to approach my teaching. At the time, I was teaching between 240-260 undergraduate students per semester. I considered myself as both a teacher and a mentor. I enjoyed the 'distinctive pleasures' (Berg & Seeber, 2016, p. 34) of teaching and learning. I believed that all students deserved support and time, especially during their first year of study. The experience of students and their success was my priority. Everything else including my research took second place. Refining and improving my pedagogical approach and assessment mechanisms became part of my daily work, constantly striving to make the learning experience of the students more meaningful, stimulating and rewarding. I wanted all students to understand the content and concepts that I taught, and I used a range of different strategies to ensure that everybody received the support they required.

My teaching evaluations were outstanding, scoring consistently high on all scales. I received numerous awards for 'Excellence in Teaching' at both a local and regional level and I was extended special invites to present my teaching philosophy and related approaches to other academics and teachers. Interestingly, I often delivered modules where the evaluation scores for my teaching were very high, yet a high percentage of students often failed. I found this puzzling – if students found the module and the associated teaching to be so effective, why were so many students failing? Approximately two years ago, I was forced to think critically about this when my Head of School raised concerns about the percentage of students not progressing to Year 2 of their respective program of study. From a management perspective the 'numbers' associated with this were unsatisfactory as it had a knock-on effect on performance metrics, degree awards and scheduling, among other things. In an attempt to explain how I critically examined my teaching philosophy, the next section of the paper focuses on empirical data related to my teaching and the performance of students.

2. Method

Measuring and examining 'teaching quality' through the lens of a teaching philosophy is complex. This could be due to the ambiguity regarding the interpretation of 'effective teaching' (Kreber, 2002; Perrott, 1982). Universities are increasingly using performance indicators (PIs) (Ramsden, 1991) to quantitatively measure performance of students and academics. In order to self-examine the effectiveness of my teaching I examined a Year 1, Semester 2 'Design and Communication Graphics 1' (DCG) module on an Initial Technology Teacher Education program over a seven-year period from 2012-2018. I was the sole leader of this module over that period. This core module has historically been cited as a 'difficult module' and a predictor of overall degree award at the end of a four-year program. The module aims to develop student teachers foundation knowledge and skills in the area of DCG to equip them to effectively teach the subject in secondary schools on graduation from university. The module is completed over a 15 week period and includes an extensive coursework element that is formatively assessed in addition to a midterm and end of term examination. Over 100 students are enrolled on the module each year. The following are the variables that were analyzed:

- **Overall Percentage of Fail Grades:** Deficient grades are undesirable for both the student and the university. Students cannot progress to the next year of their study unless this grade is cleared through a repeat mechanism. Deficient grades have a negative impact on the level of degree award obtained by the student at the end of their degree program and they also put strains on university resources and scheduling. These data were analyzed on completion of the module each year.
- **Overall Module Quality Credit Average (QCA):** This weighted score describes the quality of performance in a module ranging from 0.00 (minimum) to 4.00 (maximum). These data were analyzed on completion of the module each year.
- **Overall Teaching Effectiveness Score:** This score is based on evaluations of teaching by the students taking the module. The online evaluations are independently administered by the Centre for Teaching and Learning at the university on Week 10 of each semester. All responses are anonymous. The ratings range from 0 (not effective) to 5 (extremely effective).
- **Student Comments:** A range of different qualitative comments from students in the teaching evaluations are examined.

Interested readers should note that participants in this study were from one particular course on an initial teacher education program and that other performance indicators (PIs) such as; peer ratings of teaching, wastage and completion rates (Ramsden, 1991) were not used.

3. Findings

The data yielded over the time period from 2012-2018 are shown in Table 1. For each of the seven years, the class group size was greater than 100 students. The year that yielded the lowest QCA for the module was 2015. In that same year I was awarded a regional Teaching Award for Excellence in Teaching. This prestigious award is presented by a consortium of three higher education institutions in the local region as part of a shared mission to enhance the quality of teaching and learning. This is my most significant teaching award so far in my career. The highest overall percentage of Fail grades awarded in the module was in 2013 (25.9%) and 2016 (25.6%). In both of these years I was the recipient of local awards for excellence in teaching. This 'excellence in teaching' is supported in the consistently high Teaching Effectiveness scores in each year[1].

Table 1. Variables associated with teaching and learning 2012-2018.

Variable	2012	2013	2014	2015	2016	2017	2018
N	124	135	111	127	121	107	105
Overall % of Fails Grades	12.1%	25.9%	23.4%	11.8%	25.6%	15%	7.6%
Overall QCA	2.51	2.18	2.42	2.08	2.2	2.59	2.79
Overall Teaching Effectiveness Score	4.8/5	4.7/5	4.7/5	4.6/5	N/A1	4.68/5	N/A1

Some qualitative comments that support my student-centered, supportive philosophy in the module are evident below:

- *'Cannot praise [name omitted] enough. He is an absolutely excellent lecturer and there is a consensus about this throughout the entire course. He is very **helpful** when you ask him a question no matter how simple it may be compared to other lecturers and T.A.'s'*
- *'Very **approachable** and **helpful** lecturer. Difficult course content delivered very effectively and in an easily understood manner'*
- *'This lecturer is very good and **breaking difficult material into simple parts**'*
- *'Lecturer knows his subject area very well and **passes on** the information clearly'*
- *'[Name omitted] is almost the perfect person to teach this module, he clearly **knows his stuff** and is pretty good when it comes to **explaining** things'*

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[1] The formal Student Evaluation of Teaching was not offered by the university in 2016 and 2018.

- *'[Name omitted] is an excellent module leader. He goes through everything in detail and **<u>makes it very easy to understand</u>**'*

The selection of comments align with both my philosophy and the consistently high ratings for teaching effectiveness. Once again, this raised a concern – the students were very happy with their experience in the module yet, the performance of the students in assessments was relatively poor especially from 2013-2016. The data in Table 1 show that a marked improvement occurred in 2017 and the best 'numbers' for the module were in 2018.

3.1. Critically examining the problem

After numerous discussions with my Head of School, I agreed to investigate the root cause(s) of the consistent underperformance of Year 1 students in the module. After careful review of student demographics; subjects previously studied, grades on matriculation from secondary school, and semester workload across other modules, several conclusions were made. The academic abilities of students varied. This mixed ability was particularly evident in students' grades on matriculation from secondary school. Some were high achieving students who could easily have opted to study courses that would have demanded higher entry levels of academic achievement. Several students came from low socio-economic backgrounds or had learning disabilities, for which special provision was made to accommodate their entry on to the program if they didn't meet the minimum academic grade required for entry. This was typically a 65% grade average. I also examined workload across the other four modules that students study in the semester and found evidence that there was potentially a lack of coherency across modules and that students were overloaded in terms of contact hours, assignments, and exams.

I still couldn't ignore the fact that my teaching was considered excellent by students and the university, yet this anomaly of student underperformance persisted. I had a eureka moment in the spring of 2017; I realized that <u>I was over-supporting the students</u>.

3.2. The Root Cause

The program in which the module resides has been accredited since 2015 by the national council that governs the registration of teachers. The program was designed based on a model that reduced the contact time that students have with staff as they progress through the four-year duration of the program. My teaching philosophy aligned perfectly with this model as it afforded me the time to spend with first-year students in the lectures and labs. It afforded me the time to design all sorts of learning aids and scaffolds to help students develop the skills and understanding that would equip them to become 'excellent' teachers.
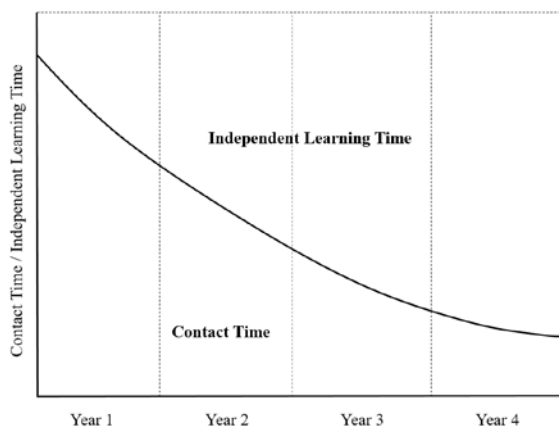
Figure 1. Contact time versus independent learning time

While the assessment of the module consistently indicated to me that there was something wrong, I didn't want to accept that it was due to student backgrounds or ability. I broke new ground when I examined the teaching evaluations for Year 3 modules I was delivering during the same period. According to the design and underpinning philosophy of the model (Figure 1), the Year 3 modules had significantly less contact time between teachers and the students. Many students were not comfortable with this and that was evident in the teaching evaluations where the effectiveness of my teaching dropped to 3.98 / 5.0 in 2017. While still a 'good' score, the mixed nature of the following comments highlights the root cause of the problem:

- *'**We are not really being taught**. We are expected to teach ourselves which is difficult to do.'*
- *'**Content needs to be covered more extensively in lectures and labs** as it is very difficult for us to participate in collaborative work if there is a gap in our knowledge.'*
- *'This module is very different to other modules that [Name omitted] has had with us. **We aren't really covering content like we would have done in 1ˢᵗ or 2ⁿᵈ year**.'*
- *'Module is ran very well, hours cut down but that is for our benefit.'*
- *'The self-learning and everything is great but **if people don't put the work in the whole thing won't work**.'*

At this moment I realized that I probably over-supported these same students during their first year of study and that when the scaffold was reduced or removed the students struggled to learn independently and collaboratively. Therefore, it is not surprising that students struggled when I was not by their side when they completed their exam in Year 1. It is also

not surprising that students' expressed dissatisfaction when my time with them was reduced as they progressed through the four years.

4. Discussion

My university prides itself on the attributes of its graduates; knowledgeable, proactive, creative, responsible, collaborative and articulate. In hindsight, I don't believe that the contact time versus independent time model presented in Figure 1 is appropriate as it arguably over-supports students with the significant amount of time that they are in contact with teaching staff during their first year of study. While this aligned with my teaching philosophy at the time, I now believe that this is potentially detrimental to students as their experience in secondary school is now arguably extended to third level and the supportive learning environment becomes normalized. Once established, it is very difficult to reduce or remove this scaffold as is evident in some of the comments received in Year 3 evaluations.

The overall class QCA in both 2017 and 2018 was the highest over the 2012-2018 period. What happened? In the spring of 2017, I decided to give students more responsibility for their learning when they commenced their studies. I assigned them weekly readings, experimented with 'flipping' lessons, and increased the amount of formative assessments. As a result, the overall QCA for the module has increased, the percentage of Fail grades has decreased, and the students ratings of teaching effectiveness remain high (4.68/5.0 in 2017, Table 1). While student comments remained generally positive, the following comment suggested that some students would still prefer to have a scaffolded experience such as the one they may have had in secondary school.

> *'I feel that there are too many self-directed hours. I believe greater understanding of course material could be attained if more lecture/lab classes were undertaken with the instructor present.'*
> *Year 1 Student 2017*

This raises the question; does such a student really need scaffolded academic support, do they lack confidence or are they lacking motivation? This is my current focus where I am investigating the merits of identifying at-risk students in the early weeks of Year 1 and providing these with special support while at the same time 'flipping' more of the learning for the more 'able' students and reducing the contact time.

5. Conclusion

I believe that this critical examination of my teaching has been worthwhile on several fronts. The university is now satisfied that students are performing better and that there are significantly fewer students failing. This has a direct positive impact on 'numbers'. Flipping

classes and reducing contact time means that the costs associated with teaching are reduced. The students are largely happy based on the evaluations of teaching and the improved overall performance means that students now have a better chance of graduating with a higher degree award. I believe that this process has helped to 'center' me in a professional sense. Reducing the time I spend with students in first year means that I now have more time to engage in my scholarship activities. My teaching philosophy and passion for supporting and mentoring students remains intact – I am merely providing a structure now that facilitates students in becoming responsible, proactive and collaborative. Lunenberg et al. (2014) describe how teacher educators who function at a high professional level will have a positive impact on the quality of student teachers and on the future quality of the education system. Through the recent refinement of my teaching philosophy and associated practices described in this paper, I believe that my teaching will not only become more effective but it will also become more enjoyable on a petsonal level, and as a result it might help combat the negative effects of the current academic climate that often forces academics into states of stress and frustration with the larger system. This paper should help to stimulate discourse in the research and teaching community in relation to what constitutes sustainable 'teaching excellence' and the importance of centering oneself between the needs of the corporate university and the needs of students.

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Sustainable Development at Higher Education Institutions in Germany: Advances, Challenges, Examples

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Abstract

In this paper, Sustainable Development at Higher Education Institutions is introduced as a field of research and application. An interdisciplinary German collaboration on Sustainable Development at Higher Education Institutions – HOCH[N] – serves as case example of how this topic is addressed on a national level. Results and advances of the HOCH[N] collaboration are summarized. Moreover, challenges of implementing sustainability-related organizational development at universities are discussed. Focusing on Education for Sustainable Development at universities, three different methodologies are outlined that exceed conventional approaches in tertiary education: Lego® Serious Play® methodology, constellation techniques, and a coaching program on the "Five Minds for the Future". They illustrate different ways of addressing issues of Education for Sustainable Development and skills and habits respectively that are crucial for achieving the global Sustainable Development Goals of the UN.

Keywords: Sustainable Development; Education for Sustainable Development; HOCH[N].

1. Sustainable Development – General Framework

The topic of Sustainable Development (SD) has a long and yet diverse history in the Anthropocene. Although the term sustainability was shaped within a forestry context in the early 1700s, a rather complex notion of care and responsibility for nature and social entities can even be tracked far back to early indigenous people (Hendry, 2014). Of course, societies, values, and knowledge have evolved ever since and thus have contexts as well as particular meanings assigned to the notion of SD. Today, as mankind is becoming increasingly aware of planetary boundaries and global societal challenges, SD is claimed and required on a large scale (Steffen et al., 2015). Global political institutions try to raise attention and action for SD and Education for Sustainable Development (ESD) respectively. UNESCO's roadmap for implementation of the Global Action Programme on ESD (2014) and especially the Sustainable Development Goals (SDGs) adopted by the UN in September 2015 emphasize the relevance and urgency of transformation towards a global, integrated view of "planet, people and prosperity". It is against this backdrop that a growing number of universities all over the world intensifies efforts to incorporate (E)SD measures into their core processes (cf. Leal Filho, Shiel & Paço, 2016). Therefore, general advances in Higher Education and Higher Education Institutions (HEIs) are substantially linked to progress in (E)SD in particular. International as well as national partnerships aim at strengthening joint endeavors for qualified (E)SD and its evaluation. Objectives of this paper therefore are: a) to provide an example for networking on SD by introducing a research collaboration called "Sustainability at Higher Education Institutions: develop, network, report" – HOCH[N]; b) to briefly discuss advances and challenges within the applied field of SD at universities in Germany; c) to illustrate methods of ESD used within the HOCH[N] context.

2. Sustainable Development at Higher Education Institutions – The HOCH[N] collaboration

Initiated by the Center for a Sustainable University (KNU) of Universität Hamburg, a research collaboration on implementing SD at German HEIs was started in 2016: HOCH[N]. It serves as a case example of how to affiliate and coordinate actions to foster SD at HEIs. Funded by the German Ministry of Education and Research (BMBF), scientists from eleven German universities[1] and multiple disciplines allied in order to accelerate SD as a topic of peer-learning and application (Bassen et al., 2017). The HOCH[N] collaboration is structured

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[1] Collaboration partners in alphabetical order: Freie Universität Berlin, Universität Bremen, Technische Universität Dresden, Universität Duisburg-Essen, Hochschule für Nachhaltige Entwicklung Eberswalde, Universität Hamburg, Leuphana Universität Lüneburg, Ludwig-Maximilians-Universität München, Eberhard Karls Universität Tübingen, Universität Vechta, Hochschule Zittau-Görlitz

along several fields of action, which all are of importance if a whole institution approach of SD (cf. UNESCO, 2014) is aimed for. These fields of action are: Governance; Research; Teaching and Education; Operations; Sustainability reporting; and Transfer/Outreach/Third Mission.

2.1. Advances of implementing SD at German universities

For each field of action, a guideline[2] based on particular research results was created, outlining insights and measures of how to incorporate SD at an institutional level[3]. These guidelines are designed as an orientation pattern for universities that just started to implement SD measures. Moreover, a strong network for SD at universities was built during the first period of the project (2016-2018). Additional universities from all over Germany joined HOCH[N] and its endeavor to strengthen SD activities in all fields of action. A digital map was set up to visualize individual as well as institutional commitment to SD (see figure 1).

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[2] as beta-version; guidelines and further information on the HOCH[N] project available online at: www.hoch-n.org; to date, guidelines are available in German only, but English versions are in preparation.

[3] Because six different guidelines were created by several author teams and based on diverse research approaches, no details of methods or data are presented here; those can be tracked via publications that go beyond an introduction of the HOCH[N] collaboration as an entity – which this paper is meant to be – and that are listed at www.hoch-n.org.
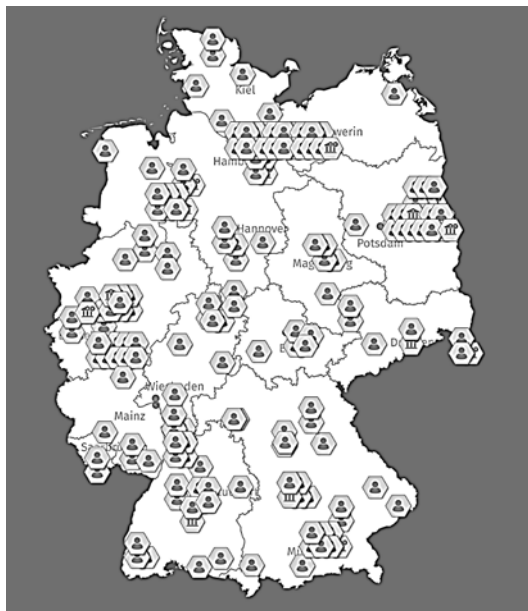
Figure 1. Digital HOCH^N map of Germany, displaying individual and institutional SD initiatives. (Source: https://www.hochn.uni-hamburg.de/en/5-mitmachen.html). The online version provides detailed information on each of the initiatives listed. Initiatives apply for inclusion on the map via netzwerk@hoch-n.org.

Individuals from more than 110 German universities (approx. ¼ of all German HEIs) are part of the HOCH^N network by now, showing the continuously growing engagement for SD at universities. In Addition, the core partners of the HOCH^N collaboration elaborated a shared understanding of the notion of SD at universities across various disciplines and institutions (Vogt et al., 2018). Going beyond a reductionist definition of SD, this shared commitment rather outlines different dimensions of transformation that have to be aligned in order to substantially change HEIs towards sustainability. Acknowledging a normative, ethical implication of SD that nevertheless should not impede academic autonomy is a crucial aspect of this shared understanding. Further aspects of it are recognizing the potentially conflicting nature of different SD targets and trying to address and cope with dilemmas (e.g. consider rebound effects and find ways to prevent them) as well as taking into account the exceptional responsibility that HEIs have not only in training and educating future generations but also as local, regional, national and global stakeholders.

To strengthen international networking on SD at universities, a HOCH^N Sustainable Development Summit (HSDS, cf. www.hsds.uni-hamburg.de) was held in collaboration with COPERNICUS Alliance – a European network on ESD – as well as the European Postgraduate Symposium on SD, a casual union of researchers who refer to SD issues in their work. At HSDS, more than 200 participants form over 20 counties in Europe and beyond exchanged their knowledge, experiences and examples of how to foster SD-related

projects and structures at universities. As HOCH[N] is an open network, it also aims at further international partners to associate with.

2.2. Challenges of SD at universities (in Germany)

The HOCH[N] network provides orientation patterns and peer-learning options for implementing SD measures at all fields of action and serves as a platform for exchange and collaboration. It contributes to advancing (applied) organizational development towards a sustainable future. Yet, many challenges arise when it comes to amplifying SD activities at universities. While not all of those challenges identified within the HOCH[N] consortium via peer discussion can be mentioned in detail here, some of the key challenges are:

– To establish and adhere to a *whole institution approach* as claimed by UNESCO (2014), i.e. to relate to all fields of (institutional) action and all stakeholders in a well-balanced and coherent way. Scattered initiatives and single projects for SD are relevant starting points, but (E)SD can only permeate organizational / university culture if it is systematically and comprehensively incorporated into the higher education system.

– To find ways of *identifying and solving antagonistic effects of SD-related endeavors*, such as conflicting impacts in terms of ecological and social dimensions of SD, for example. Within the science sector, the goal of internationalization on the one hand and reducing CO_2 emissions due to travel on the other are a striking case of conflicting goals. Both targets are pertinent for universities in a globalized world and although digital tools allow for alternatives to travel, still new solutions and pathways of how to achieve one target without compromising the other have to be found and tested.

– To *foster inter- and transdisciplinary research and collaboration*, not as a substitute but as added value to conventional disciplinary work. Of course, this is bound to efforts and time resources which are usually very restricted anyway. Reinforcing teamwork across disciplinary and other boundaries still is necessary on a large scale to ensure transformation towards SD. This also is bound to the enhancement of new research profiles and identities, i.e. altered self-concepts of disciplines (from mono- to multi-disciplinary research identities).

– To *enable new ways of learning*, which not only means project-based learning and interactive teaching as modern forms of knowledge and skills acquisition. It also refers to different conceptions of learning and the way we are used to deal with problems and problem solving. Scharmer (2016), for example, outlines learning processes according to "Theory U" as sophisticated for SD and future-oriented leadership. This means to completely transcend conventional ideas of research, studying and education (cf. Bellina et al., 2018).

Further challenges of SD at universities and especially of implementing ESD within tertiary education are discussed by Barth et al. (2016), for example. As emerging field of research and application, (E)SD at HEIs in the context of the global SDGs provides many different prospects. Progress of the HOCH[N] collaboration in addressing the mentioned challenges will be shared on the website [www.hoch-n.org.](http://www.hoch-n.org)

3. Examples of ESD approaches: New perspectives for Higher Education

Many different approaches of how to integrate ESD into tertiary education do exist (cf. Barth et al., 2016.), some focusing on special SD content (such as introducing the SDGs; detailed know-how concerning environmental protection, etc.), others focusing on didactic issues (such as project-based learning; living-labs; peer-learning, etc.). Building capacities in terms of knowledge and – even more essential – *sustainability-related habits and skills* is key in ESD. In order to illustrate advances and new perspectives for ESD at universities, three examples of approaches explored within the HOCH[N] context are specified. Of course, these selected examples are not exhaustive, neither for HOCH[N] nor for ESD in general. Yet, they bring in progressive models and methodologies for further discussion as well as evaluation.

3.1. Creating shared visions via serious play techniques

Research on team processes and performance shows that shared mental models are important for effectiveness and achievement (Mathieu et al., 2000). Thus, generating shared mental models and visions of how sustainable universities of the future might look like is a proper first step for achieving sustainability-related university development. In addition, Design Thinking as well as Serious Play are recent tools that help substantiate rather abstract notions. This is why Lego® Serious Play® (LSP) methodology is used as a means for teamwork on SD. In a series of workshops, LSP was introduced and applied in order to elaborate on shared visions. Some of the key elements referred to in different models and workshops were, for example: *strong connections between universities and society*; *people from all status groups and disciplines cooperate*; *high-tech and green solutions are integrated at campus*; *awareness of SD is at the heart of each university*.

3.2. Enhance explorative learning via constellation techniques

New ways of learning and problem solving in order to cope with the claims of global SD require not only an openness to new perspectives but also new methodologies and lines of (self-)reflection. Explorative and reflective attitudes can be trained by constellation techniques that are rooted in early ideas of sociometry and psychodrama (Moreno, 2001). Theories, models, hypotheses are visualized "on stage", i.e. going beyond mere discussions, information and their dynamics (constellations) are put into action by persons.

Constellation techniques are interactive methodologies that can help to generate new insights and interpretations of situations and patterns. Exploring possible ways of interaction between systemic elements via roleplay and/or "vicarious perception" can be used as powerful tools of experienced-based group learning. A detailed and comprehensive description of how constellation techniques are applied within research and teaching provide Müller-Christ and Pijetlovic (2018).

3.3. Train integrated mindsets, e.g. "Five Minds for the Future"

System thinking and integrated mindsets are crucial for tackling SD-related problems and for generating solutions of the grand challenges of the Anthropocene. Various theories and models do exist that describe key skills of future viability. One of those is the idea of the "Five Minds for the Future" by Gardner (2006). He thoroughly delineates five mindsets and virtues that are seen as essential for future education and vocational training. Whereas each of these mindsets is of relevance per se, their integrated training makes the difference for success. The five mindsets are:

1. The *disciplined mind*, including: deep understanding and experience of at least one field of profession; a mastery of different schools of thought; a motivation for life-long learning.
2. The *synthesizing mind*, including: detecting parallels and patterns of concepts; being able to bridge gaps and to connect, to identify and use synergies, to bring thoughts, views and theories together.
3. The *creating mind*, including: ability to generate new ideas and solutions to problems, to transcend current standards and viewpoints; driven by curiosity and pioneering spirit.
4. The *respectful mind*, including: social skills such as empathy and active listening; communication competences in general, especially to communicate with others in a respectful and appreciative way; grant tolerance and benevolence to others; overcome prejudice.
5. The *ethical mind*, including: reflection and application of ethical principles; mature understanding of fairness, truthfulness, loyalty; adoption of (social) responsibility and critical self-reflection.

Special programs developed for fostering these "Five Minds for the Future" in an integrated way based on coaching methods (Schmitt, 2014) thus address SD-related skills.

4. Conclusion

In this introductory paper, SD at HEIs was presented as a general topic and as a particular collaboration project of German universities (HOCH[N]). The HOCH[N] network is open to connect with further national and international partners in order to foster sustainability-related organizational development and ESD at universities. Advances of the HOCH[N] initiative so far were summarized. Additionally, some key challenges of implementing SD at universities were noted: Referring to a whole institution approach; identifying and addressing antagonistic effects of SD; fostering inter- and transdisciplinary collaboration and new professional profiles for scientists; allowing and enabling new, unconventional ways of learning and endeavor. Focusing on ESD, the final section of this paper exemplified some methodologies and concepts used within the HOCH[N] context. With the case of HOCH[N] and the given examples, we hope to promote discussion about SD at universities as well as transformation within the sector of tertiary education. We hope to strengthen peer-learning on SD and to contribute to a professionalized research and application of SD at universities.

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New University: liberal education and arts in Brazil

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Abstract

This paper is part of an ongoing research on the issue of music education in Brazilian universities. It aims to identify educational models that structure pedagogical practice at this level of studies. It distinguishes the types of professional and human education promoted in each one of the presented models (French, German and American) as well as liberal education, identified as a global trend. Relating the current socio-cultural political and economic context with education with the support of Godwin (2015), Berg (2012) and Jansen (1999) we argue that liberal education provides a structure that can favor the development of competences and skills demanded on the current conjuncture. In this frame, we will analyze, with the support of Paula (2008) and Santos & Filho (2008), the historical dynamics of Brazilian higher education and show how liberal education and post-colonial philosophy is restructuring Brazilian universities. This "new university" allows the implementation of a multicultural, multi-epistemic pedagogy that overcome fragmentary disciplinary views and renders feasible the proposition of new ways of conceiving training, studying, teaching and research in music and arts.

Keywords: Higher Education; Educational Models; Liberal Education; Brazilian University; Music and Arts.

1. Liberal education

Based on the analysis of the Global Liberal Education Inventory (GLEI), a catalogue about liberal education programs located outside the United States, Godwin (2015) provides an initial profile about the emergency of liberal education, highlighting where, when and in what formats liberal education is emerging throughout the world.

According to the author, contemporary liberal education is commonly associated to the US liberal arts colleges but is also present in some American research universities. She observes that although the emergency of contemporary liberal education in the US dates from end of the 19th century, its diffusion as a global phenomenon is recent dating from the 2000s with the emergency of liberal education in Russia, India, Israel, Nederland's, Chile, Bangladesh and Brazil. [1].

According to the GLEI, liberal education is

> (1)interdisciplinary providing a broad knowledge base from social science, humanities, and natural/physical science; (2) includes a "general education" protocol, courses or curriculum required for all students in a program; and (3) emphasizes at least two of the following: transferable skills—written and oral communication, analysis and synthesis, problem solving, information and quantitative literacy, reasoning or logic, critical thinking, creativity, etc., citizenship/social responsibility/ethics, global competence, and/or student-centeredness and holistic student development. (Godwin, 2015, p. 2)

Liberal education differs from the organization format consolidated as norm for studies in higher education: specialized curriculum, carrier focused with professionalizing studies support and utilitarian philosophy (Godwin, 2015). In other words, liberal education opposes the idea of early professionalization – it envisages culture and the expressions of truth as development basis before looking for professionalization. At the same time, its focus in transferable skills results in higher adaptability to the changing needs of a constant changing society and to the instability context in working and jobs relations that emerges from the neoliberal conjuncture. Hence, it rises as an alternative to curriculum organization in the contemporary world.

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[1] Liberal education is present in 58 countries in five continents, divided as follows: Asia 37%, Europe 32%, Middle East 9%, Latin America, 4 %, Oceania 4% e Africa 2%. In North America, Canada has 21 programs. The years of 2000 are emblematic regarding liberal education expansion: 44% of the courses have been founded since then. Furthermore, after this date public initiatives have overtaken privates by 20%. However, according to Godwin (2015) although the expansion is a tendency there are implementation difficulties of liberal education. The phenomenon occurs on the peripheral area, not influencing the traditional education system: only 2% of the countries that possess liberal education have more than 10 courses. The percentage dilution in face of the massive number of traditional initiatives hardens a higher influence of liberal education over its own valorization (Godwin, 2015, pp. 2-3).

2. Traditional models of higher education in Brazil

In the past few years, Brazil has advanced important steps regarding higher education. Gomes and Moraes (2012) show that from 2002 the country surpassed the figure of 15% of the enrolled population, which, according to Trow (2005) indicates the shift from an elite System to a Mass System. However, the hegemonic university models did not follow global tendencies and emphasize an anachronistic, fragmentary view, with focus in monodisciplinary careers. The bibliographical review of Sguissardi (2005) and Paula (2008), pointed that the French, German and American models have led the historical development of modern university, structured Brazilian university experiences and been promoting, respectively, technical/professional formation, humanistic, scientific, integral formation and superior formation with adequacy to the market demands.

According to Paula (2008), first higher education experiences in Brazil were funded in 1908 for the Portuguese cohort over the influence of the French model. She identifies an influence of the German model in the foundation of the University of São Paulo in the 1930s during the first republican era. As well, as notices that the university reform of 1968, during the military era, brought it close to the American model.

Since them, Brazilian University has consolidated its triple function of teaching, research and extension. The idea of education has been associated to that of merchandise: the existence of a linear bind between education and economic development and working market, has been promoted, as well as stimuli for partnerships between university and the productive sector. Because of it, there was certain expansion of higher education; the principles of unified selection were established, as well as the cycle's regime, short-term courses, and the consolidation of the academic career. However, the German ideal of integral, humanistic and uninterested formation has been substituted by the instrumental rationalization and fragmentation of the intellectual work (Paula, 2008, pp.75-76).

For the author, since the 1980s, in the neoliberal economic political context,

> (…)The American model has become hegemonic. We watch a 'mcdonaldization' of schooling mostly in the private sphere. A banalization of higher education to attend the demands of the job market and of clients in search for a university degree. (Paula, 2009, p.78)

In this context, questions about productivity of universities and the quality, efficiency and effectiveness of teaching developed in them gain prominence. Despite the positive aspects, the commercial logic of serial reproduction and the fragmentary form of organization have led to the graduation of professionals with unilateral profiles that are not totally prepared for the contemporary world demands and for those of the market job.

The finding of the problem, as Jansen (1997) points out, requires rethinking the role of university. According to the author, the fragmentation of school organization refers to the nineteenth century, when school structures attended demands of the industrial society. For him, this model did not follow structural changes of information society and needs revision. The digital-cognitive society results in multiplicity, confluences, and synchronicities, produces new realities and brings new demands requiring new individual and collective attributes. New collaborative structures sustain network organization claiming up for the development of new social forms of creating knowledge and new manners of dealing with information. In this context, educators must not only keep and transmit information but also favor the development of adequate competences and skills for this context: to access, extract, interpret information, stablish connections in order to produce knowledge, adapt and create.

Based on his findings and considering the perspective defended by Danish Professor Lars Qvortup, Berg (2012) highlights the need of developing learning competences (the ability to learn and continuously re-significate their own learning). Communication competences (essential for social collaboration: capacity to communicate, selecting what is pertinent and in a given situation and being able to understand the point of view of other cultures) and formulation competences (ability to observe latent values that have not yet been outsourced and which, therefore, involve thinking, relationships and forming opinions skills). Thus, transformation must involve structures modernization in the whole educational system: it becomes necessary to update forms of action, organization, purposes and the educational models themselves, seek for greater dialogue, interaction, traffic, interdisciplinarity and the development of competences for a more autonomous learning.

3. New university

Proposal of Santos and Filho (2008) the project "Universidade Nova" (New University), intends to restructure Brazilian university. It points to an organization model, which is based on the cycle's formation scheme that intends to fix following problems analyzed by the authors:

> 1. Excessive precocity in choosing a professional carrier; 2. Limited, punctual and traumatic selection in graduation; 3. Monodisciplinary view in graduation, with narrow and retrograde curriculums; 4 , Huge gap between graduation and post-graduation; 5. Submission to the market, loss of autonomy; 6. Almost complete incompatibility with other academic models architecture currently in use in other universities realities, specially those from developed countries; 7. Non-culture: technological/professional formation, when efficient, culturally poor; 8. Anachronism: dissonance from the contemporary conjuncture or university. (p.157).

This leads to the following outspread:

> To introduce in higher education relevant themes of contemporary culture, which, considering the multicultural diversity of the current world, means, think in cultures, in plural; Endow higher education with mobility, flexibility, efficiency and quality, targeting compatibilization to the demands of higher education on the contemporary world. (Santos & Filho, 2008, p. 199-200).

The proposed curricular structure intends to implement a three-cycle system of university education: general education (pre-graduation), specific training (undergraduate studies), and specialized professional training (postgraduate studies). The first cycle provides general training in a modality of courses called Interdisciplinary Baccalaureates (IB), which goes through the areas of scientific, technological, artistic and cultural production and is a prerequisite for the next cycles. The Second Cycle contemplates specific, professional training, with a concentrated curriculum. The third cycle corresponds to post-graduation in professional or academic category and at masters and doctoral level.

The cycle regime is compatible with the contemporary international model, with the North American (Harvard) and the European unified model (Bologna Process). However, although there are similarities, the model designed for the Brazilian reality seeks to contribute to the national identity. For the authors, the main differences between the processes are that the US pre-graduation is longer and more dense, requiring exclusive dedication. On the other hand, the Bologna Process presents, in many early cycles, very specialized curriculum structures unlike the idea of interdisciplinarity proposed here. (Santos & Filho, 2008, pp.231-238).

Interdisciplinary Baccalaureates are composed by a set of specific areas encompassed in a previously defined larger group, such as IB in Arts, IB in Humanity, IB in Science and Technology, IB in Health. In the first cycle, IB has a common structure for all students, but each student may choose a distinct Concentration Area (CA) where develops targeted studies. Blocks and Curricular Axes in modules (courses, disciplines, activities, programs, and oriented work) are also part of it. Thus, it allows student mobility through departments and disciplines, favoring the development of broad knowledge and deep skills in an area of knowledge. (Santos & Filho, 2008, p.202).

The scheme estimates the completion of the first cycle in 3 years with a total working load of at least 2,400 hours. The choice of a Concentration Area happens from the 4th semester of the course. Once it is completed the student has a range of options: he can complete his training in technological courses from two to three semesters, take the selection exam for the second cycle in specific education degrees (to be completed in another 1 or 2 years), or in professionals careers (from 2 to 4 years). It is also possible to apply for masters and direct doctorates, dependent on curricular evaluations.

The proposal also indicates a better articulation between undergraduate and graduate studies and allows the student to take subjects at different levels. Researcher formation gains more

autonomy because it can happen in parallel with professional formation. That way, research is developed with emphasis, from pre-graduation. At the same time, post-graduation opens the possibility of master's degrees and professional doctorates, as in international models, surpassing the paradigm of professionalizing post-graduations and specializations that exist as alternative to high-level professional education in the hegemonic system (Santos & Filho, 2008, p.233).[2]

4. Final considerations

Throughout this paper, we argued that liberal education presents a structure that contributes to the modernization and reorganization of universities in the contemporary scenario. Relating this structure and the skills developed on them with the social, political, economic and cultural demands that emerge from the neoliberal conjuncture, we understand the existence of forces that propel liberal education as a trend for the area. At the same time, as it promotes a paradigm shift and adaptability it can favor the development of different educational proposals, adequate to different realities.

When analyzing "New University" proposed in Brazil, we highlighted that it emphasizes the importance of a propaedeutic stage with combined studies of different areas from social science, humanities, and natural/physical science together with the possibility of research development from the earlier stages of higher education. Thus, it recovers part of the German ideal of humanistic formation. However, the philosophical base behind it results from the evolution of the postcolonial and de-colonial thinking that has valued other non-Eurocentric epistemologies and interdisciplinary/transdisciplinary work proposals. These proposals seek to achieve through an "ecology of knowledges" (Santos & Filho, 2008), an integral, holistic formation of the individual, with the valorization and equalization of local and regional cultures to the formal and traditional ones. Thus, it can lead to the implementation of a multicultural and multi-epistemic perspective overcoming fragmentary, disciplinary views and with the proposition of new ways of conceiving training, studying, teaching and research.

Concerning the study of the arts, the propaedeutic stage allows interdisciplinary studies. It is possible to think from it, the structuring of a "basic cycle of arts", a preparatory stage in which studies are carried out in various artistic areas: dance, music, theater, visual arts, literature, film and audiovisual. This propaedeutic stage can promote a generalist formation in the field of arts and contribute to the resolution of the complex problems projected over university currently. It may favor the promotion of multiple, plural education that values different cultures, including those local and non-hegemonic ones that have historically been excluded from higher education art studies.

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[2] It is worth noting that in the traditional system masters and doctorates are academic and work as preparatory steps for the academic career.

Obviously, the propaedeutic stage opens doors for future development, but does not exempt the realization of deep studies in specific areas. After the basic cycle, the second cycle promotes specialization in one of the areas that compose it, leading to artistic or educational careers in arts. In addition, the third cycle, postgraduate, promotes research and development of artistic projects and products (books, records, DVDs, games, methods, etc.) as well as specific training for higher education professors.

Regarding pedagogical possibilities, the ecological and multi-epistemic idea favors an expansion of teaching-learning possibilities in music and arts which detailing constitutes a later stage of this research. So far, we understand that through this process it is possible to create spaces of experimentation in which one can combine practical studies with the systematized ones, promoting both the intuitive and the rational knowledge, aiming at reaching the artistic, the transcendental. Edification of spaces for involvement, performance and interdisciplinary collective creation. Spaces where are possible to promote more than technical studies aimed at producing / reproducing artistic works, but an integrated system of shared and meaningful learning about different segments of the artistic culture.

Finally, following the idea of interconnection between cycles presented before, we understand that such proposals may favor greater artistic and pedagogical development: collective experiences, artistic experimentation, development of techniques and projects, assembly of spectacles and collaborative learning relationships. Thus, it is possible to constitute a space for artistic development, research and teaching practice in a broader way, with which we seek to contribute here and which, we believe, demands a constant process of collective construction.

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Measuring which support systems really work to improve students learning in your class – A case study on quantitative methods courses in the social sciences

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Abstract

While the so-called "datafication of society" increased the societal relevance of quantitative data analysis, social science students – who should use such data to understand and explain society – are often skeptical towards quantitative methods and overwhelmed by it.

Thus, universities around the world should find means to help their students improve their corresponding analytical skills.

The paper uses a case study from the University of Salzburg – Austria – to illustrate which aspects actually improve student-learning outcomes in the field of quantitative methods. The researched aspects focus on the program and institutional levels and address two specific issues: The evaluation and feedback on student performance and the introduction of additional support structures.

While homework and feedback still show the best results additional – technology based – approaches like video-tutorials have a significant impact on student performance.

***Keywords:** Datafication; Video Tutorials; Student Feedback; Quantitative Methods; Social Sciences Statistics.*

1. Introduction – Two competing worlds

The *Adult Skills* survey of the Organization for Economic Co-operation and Development demonstrates that one in seven workers worldwide uses advanced mathematics and statistics in their profession (OECD, 2016). A number that will most likely grow in the future, as the so-called "datafication of society" (Lycett, 2013, 383) – based on the rapid expansion of digital communication technology – led to a seemingly endless stream of quantitative data. This also results in the necessity to discuss further associated social implications (Couldry & Mejias, 2018). On a daily basis the media, politicians, teachers, and friends, use data to illustrate their arguments. At the same time the tools that shape this "datafication" – be it comments and posts on Internet blogs, social media etc. – reveal that a significant number of individuals has difficulties to distinguish between opinions and factual data (Nardi, 2018), resulting in a broad skepticism regarding the general reliability and validity of quantitative information.

Consequently, teaching quantitative methodology in higher education, especially in the field of social sciences, becomes more important than ever. Disciplines like sociology, political science, communication studies etc. train students to understand and analyze society. Alumni of these programs need to understand both potentials and limits of data. They must be able to judge data quality and provide meaningful interpretations. Yet, past studies show a negative bias of social science students when it comes to statistics and quantitative methods (Zeidner, 1991; Carter et al., 2017). Therefore, two competing narratives exist: While the relevance of quantitative data to society increases, the group of individuals that should use it to understand and explain society is skeptical towards quantitative methods. Thus, universities around the world should look at the quantitative methodology courses in their social science curricula and find means to help their students improve the corresponding analytical skills. This paper tackles those issues in particular. Section 2 discusses potential strategies to improve students' success. Section 3 introduces a case study from the University of Salzburg (Austria), before a discussion and the results follow the paper. However we argue that the methods we applied to test student support systems and their outcome is of general interest and does not only account for quantitative methods courses.

2. Theoretical implications and the selected case study

The paper tests to what extent are different strategies, which are proposed by recent literature, improving student-learning outcomes. The researched aspects focus on the program and institutional levels, addressing two specific issues: The evaluation and feedback on student performance and the introduction of additional support structures.

The first part covers traditional student evaluation and team orientated practices that may help students improve their knowledge over the duration of a semester. As quantitative

methodology is seen as a challenge by students, team based learning provides a potential solution. Teaming-up to solve problems, sharing gained knowledge and working collaboratively should improve learning outcomes via peer-feedback and support (Michaelsen & Sweet, 2008). As methods-classes often require students to follow complex examples and explanations during class, time available for in class assignments is short. Homework provides the opportunity to compensate for this, as students can engage with the material on their own, and the lecturer can individualize feedback. The most comprehensive meta-analyses dealing with the effects of homework – done by Cooper (1989) and her colleagues (Cooper et al. 2006) – cover the period between the 1930ties and 2003, illustrate that there is a general positive, statistically significant correlation between the amount of homework and learning outcomes (Cooper et al., 2006, p. 48). This also extends to the chance for students to resubmit work after receiving feedback on their assignments as well. However, to implement those procedures properly, lecturers need to manage groups, develop suitable tasks that help individuals or groups to improve and give feedback (Michaelsen & Sweet, 2008).

To cover the second aspect – additional support structures – research indicates that lecturers often report students entering their classes with a deficit in the math skills, which would be needed for succeeding the course (Baharun & Porter, 2012; Kay & Kletskin, 2012; Winch & Cahn, 2015). Thus, it seems sensible that quantitative methods courses could benefit from tools that would establish a more uniform knowledge, preferably without effecting the time allotted to new content (Winch & Cahn, 2015). Different solutions to this can be found in existing literature (Ayres 2006; Mayer et al. 2002), including: (1) the introduction of supplemental material, e.g. extensive manuals explaining statistical procedures. (2) The reorganizing of the material into smaller parts so students can learn incrementally, e.g. splitting material in different subchapters that students can digest in shorter timeframes. (3) Offering individualized feedback and discussion of problems with the material, e.g. using a student assistant to explaining tasks that are necessary for class in extra tutorial units.

Technological advancements and the prevalence of social media made it possible to provide such structures not only via written scripts (manuals) or tutorial units, offered by student assistants, but also via pre-made tutorial videos. They are a potential tool to address some of the difficulties found in teaching quantitative methods, especially when used to supplement and not to replace a lecture (Kay & Kletskin, 2012). They allow students to portion the material, fitting their learning regime, repeat or skip parts as necessary and directly demonstrate the steps necessary to complete the task. Yet, it takes considerable time and planning to produce them and implement them within the framework of a lecture or course.

Additionally, individual students may show different levels of academic engagement – understood as the "quality of effort students devote to educationally focused activities that contribute directly to desired outcomes" (Kuh & Hu, 2001). While it is a robust predictor for

learning outcomes, it is multi-dimensional; involving students' emotion, behavior, and cognition (Finn & Zimmer, 2012). Thus, it lies outside the scope of this paper, which deals with program based initiatives.

2.1. The presented case study – The Seminar Quantitative Methods in Communication Studies

Building upon the previous assumptions, the case example of this paper will discuss the seminar on quantitative methods in communication studies from the University of Salzburg. Officially, part of the fourth semester in the BA-program, the class grants students 4 credits according to the ECTS regulations (Workload: 100 hours). Students are expected to have completed an introduction lecture on empirical social sciences as well statistics before.

The main task of the course is to introduce students to uni- and bi-variate data analysis via a statistics software package – SPSS –, teach them how to design as well as field a small-scale survey. The curricular requirements for completing the class are a written exam, testing their knowledge regarding statistical procedures, as well as a final paper, presenting the results of their own survey. There is no adjustment of grades based on class performance; e.g. there is no grading on a curve. The absolute score is assigned a numeric grade: *1 – very good* (Scores 91-100%), *2 – good* (Scores: 81-90%), *3 – satisfactory* (Scores: 67-80%), *4 - sufficient* (Scores: 51-66%) as well as *5 –failed* (Scores: 0-50%).

Despite the fact that content and the corresponding guidelines are comparable to other social science methods classes in Austria, seminar lecturers were confronted with students claiming that they are overwhelmed. This sentiment effected course evaluation as well: It was consistently scored lower than others in the program. At the same time, the responsible lecturers were not satisfied with the learning outcomes of the students, as they should prepare students for social scientific work (Prandner & Moosbrugger, 2018). Thus, it was decided to test different ways to improve student performance and overall satisfaction with the course.

3. Data and Hypothesis

The presented data was collected by the module coordinator for empirical research methods at the department of communication studies at the University of Salzburg, limiting the valid cases to 147 students, taking the class between 2014 and 2018. However, it increases the comparability as well as the consistency of the measurements, as other lecturers were not part of the faculty and thus rotated from year to year. To test which of the initiatives improve the learning outcome – measured in the form of standardized grades and thus a limitation of this project – different arrangements of feedback based and support structures based initiatives were tested over the courses in five years (overview: Table 1). The reason why different measurers were tested each year ties to financial and staff limitations. E.g. the production of

extensive supporting materials – in 2015 a *manual* with 150 pages covering the course content was written by two lecturers – tied up resources that were not available otherwise. Student assistants had to be used strategically as well, as e.g. group tutorials take away time that may be used for grading papers or tests in other semesters.

Table 1. Structural info on the researched courses.

Info	2014	2015	2016	2017	2018	Total	Exp. Effect
Number of Students (N; multiple values indicate multiple groups)	28	18 + 22	21	14 + 19	11 + 14	147	
% of Female Students	68%	75%	62%	64%	64%	67%	
Grade (Final; 1 „very good" to 5 „failed"); Mean (std. Dev.)	2.04 (0.8)	1.98 (1.1)	2.19 (0.8)	2.64 (0.9)	3.12 (1.2)	2.37 (1.1)	
Grade (Exam; 1 „very good" to 5 „failed"); Mean (std. Dev.)	2.08 (1.1)	1.93 (1.2)	2.71 (1.0)	2.00 (0.9)	3.24 (1.2)	2.31 (1.2)	
Group Tutorials	No	Yes	Yes	No	Yes		+
Ext. Supporting Material - "*manual*"	No	No	Yes	Yes	Yes		+
Video Tutorials	No	No	Yes	Yes	No		+
Individual papers (no group learning)	Yes	No	No	Yes	No		-
Resubmitting of final paper – "Redo"	Yes	Yes	Yes	No	No		+
Homework incl. feedback	Yes	Yes	Yes	Yes	No		+

Source: Own depiction (2019).

To improve student performance, the aforementioned *manual* was produced which covered the core course content and followed the layout of the course – including supporting material they could use during one's own survey project, layouts for statistical tests and examples for their application, visualization and interpretation of results, as well as a guide for SPSS use. Additionally eight *videos* – each approximately 20 Minutes – were produced covering SPSS usage, made available via the department's online platform. However, the resources necessary to update them were not available. Thus, they were not used in 2018. Those initiatives were in some years accompanied by group based learning initiatives that helped students write their final paper in groups of 3 to 5 members. When it comes to feedback-based initiatives group tutorials were offered. Student assistants provided feedback, discussed examples not covered in class and individual problems. Additionally it was tested, if written homework, which got individualized feedback, could improve performance. It

consisted of five different statistical problems and affected the final grade. The last initiative was the chance to resubmit a paper, which would have resulted in failing the class, and adjust the paper based on feedback of the lecturer.

All of these initiatives were included in a path model that uses linear regression (see figure 1); aiming to explain which of initiatives would influence both, the outcome of the exam as well as the final grade, the most. The class size and the sex of the students were used as control variables. The calculations were done via IBM SPSS V24 as well as AMOS V23.

4. Results

The results of the path model are mostly matching the expectations laid out in section 2 and the full model is quite good in regard to the final grade (adjusted $R^2 = 0.451$). However, it has to be stated that the influence of extensive supporting material – the *manual* – had to be excluded as it resulted in collinearity in the model. Nonetheless, the results shows that the feedback-based initiatives like homework as well as the group based learning had an influence on the outcome. These results are not completely matching literature based assumptions: Bigger project groups produce significantly ($p<0.05$) worse results in the course than smaller ones. This may indicate that weaker individuals in groups are not getting better results when getting the chance to tackle problems collaboratively. When it comes to mandatory homework, a positive impact on the performance can be seen for the exam. However, students who submit weak homework receive worse final grades, as it is part of the overall grading scheme. By looking at the supporting structure, both, group tutorials as well as video tutorials, had the tendency ($p<0.10$) to negatively affect student performance in the exam. An explanation for this may be that the availability of these materials lead students to be less motivated to engage with the course material on their own. However, the group tutorials show a tendency to have a positive effect on the final grade. Looking at the control variables, it becomes clear that there is no gender effect and the exam performance correlates strongly with the final grade. However, bigger classes have a tendency to perform better. A potential explanation may be, that bigger classes increase the chance of well performing students offering advice to weaker ones. However, this would be competing with the assessment of the group related learning stated before.
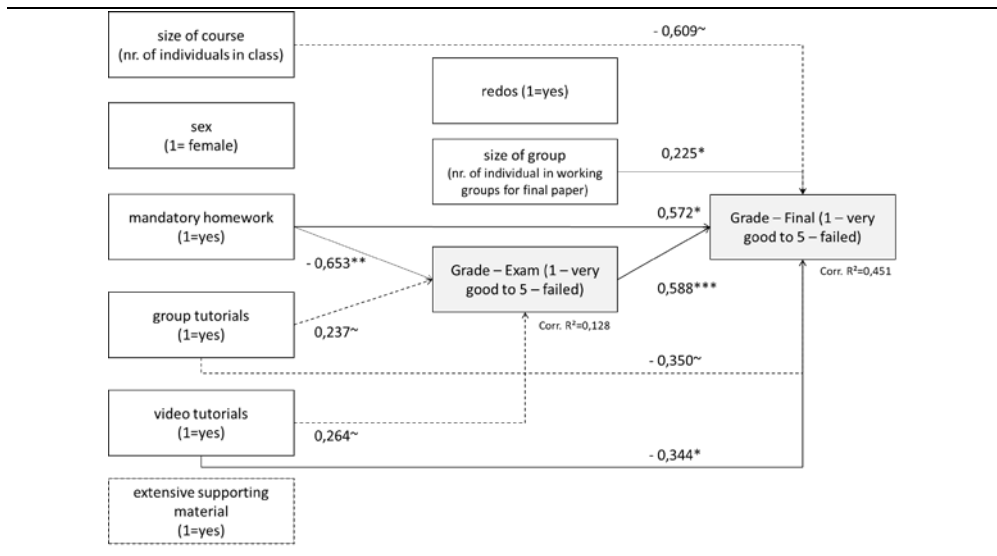
*Figure 1. Path model based on linear regression models, arrows indicate direction of influence. Reported effects are based on standardized Beta coefficients (n=145, (~ p<0.1; * p<0.05; ** p<0.01; *** p<0.001))*

5. Conclusion

As quantitative data is becoming deeper and deeper ingrained into our daily lives, the need to confront and discuss those numbers, will be a more common part of typical jobs for social scientists. When it comes to teaching empirical methods in social sciences, lecturers and professors have to adapt to this as well, if they want to improve the learning outcomes of students.

Despite the promising results provided in section 4, the study has several limitations. Those are mostly tied to the resources available at the department. It was impossible to assess the performance of all students in the program and not all procedures could be tested in unison. Additionally, student performance was only measured via grades, which are an abstract form of indicating knowledge gains. Nevertheless, the results of the case study make it clear, that a mix of feedback, as well as support driven factors, are influencing student performance in quantitative methods classes. Video tutorials to support students and group tutorials for discussions of specific problems are valuable tools increasing student performance. When it comes to more feedback orientated structures, the model illustrated that homework improves exam performance and thus is advantageous to improve the most commonly needed skills.

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Internationalising education – Cross-country co-teaching among European higher education institutions

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Abstract

Many lecturers preach teamwork, but they do not practice it by sharing responsibility for classes. Particularly in a transnational context, inputs from lecturers and learners from various countries might be beneficial for students' learning. This paper asks the question: How can higher education institutions (HEI) set up cross-country and cross-HEI co-teaching to facilitate the transfer of host and home country knowledge? The authors provide insights into a transnational co-teaching project that partly relies on virtual distance learning across countries. This real-life project supports small and medium sized enterprises in their international endeavours with the support of lecturers and student teams from the respective host countries as well as their home countries. The authors discuss advantages and disadvantages of cross-country and cross–HEI co-teaching in comparison to traditional teaching methods. Furthermore, the authors elaborate on the impact of virtual distance learning in comparison to in-class teaching at a single physical location. Due to the international nature of the project, it mainly relies on distance learning that can be very effective when implemented correctly. The paper provides lessons learned from the project that might be beneficial for lecturers with and without international components in their teaching.

Keywords: Internationalisation; co-teaching; virtual teams; distance learning.

1. Introduction

While many lecturers emphasise the importance of teamwork for their students, the actual teaching in higher education institutions (HEI) still depends mainly on the knowledge and efforts of a single lecturer responsible for the respective module. It therefore seems that lecturers do not practice what they preach.

Co-teaching is widely known as a method that facilitates the learning of groups with diverse abilities or special needs (Austin, 2001; Murawski & Lee Swanson, 2001). However, its application at the higher education level is less intensively studied (Bacharach, Heck, & Dahlberg, 2008). Wenzlaff et al. (2002, p. 14) define co-teaching as "two or more individuals who come together in a collaborative relationship for the purpose of shared work […] for the outcome of achieving what none could have done alone." Therefore, co-teaching appears to be particularly useful in cases where the lecturers have a diverse competence base.

Modules related to the internationalisation of businesses seem to be an interesting field for the application of co-teaching in a HEI context. These modules address the tasks and difficulties that occur when an organisation operates in a home and a host country. Knowledge of both countries is required and it therefore seems desirable to gain first-hand knowledge from partners of the host and the home country. Involving a larger set of individuals from both countries allows all participants to learn from one another (Tajino & Tajino, 2000). This paper therefore asks the question: *How can higher education institutions (HEI) set up cross-country and cross-HEI co-teaching to facilitate the transfer of host and home country knowledge?*

The paper contributes to education methodology in the following way: We first illustrate a practical implementation of co-teaching in a transnational HEI context that requires virtual distance learning. This can be used as a template for further projects. Second, we compare the advantages of co-teaching and traditional teaching models and share some lessons learned. Third, we elaborate on the necessity of a shared single physical location for teaching and the experiences with virtual distance learning across countries and cultures.

2. Theoretical Foundations

Unlike most applications of co-teaching and team-learning, its use in a transnational setting is subject to distance-related challenges. Participants are usually not in one single location, but spread between the home and host country. Therefore, costly travels or forms of distance learning are necessary. Some popular definitions of co-teaching (e.g. Bacharach et al., 2008, p. 9) explicitly emphasise the notion of a 'single/shared physical space' to ensure its success.

The literature on distance learning, "the separation of teacher and learner in space and/or time" (Sherry, 1995, p. 338) is not conclusive in this regard. Unlike the literature on co-

teaching, some reviews conclude that most studies suggest that distance learning compares favourably with instruction at a shared physical space (e.g. Phipps & Merisotis, 1999). A meta-analysis by Bernard et al. (2004) suggests that the results vary substantially, depending on various context factors, such as synchronous versus asynchronous teaching, with distance learning being more successful in an asynchronous teaching context. Moreover, the use of computer technology seems to be supportive for the success of distance learning. The literatures on co-teaching and distance learning therefore do not provide univocal suggestions on the necessity of a shared physical space and both forms of education might be worth exploring in this context.

Commonly reported challenges of distance learning within transnational virtual teams are communication problems and missing trust (Jarvenpaa & Leidner, 1998). Communication problems that mostly relate to multilingual backgrounds can be solved with an adequate media infrastructure, the motivation to rely on various forms of media and 'redundant' communication (Tenzer & Pudelko, 2016). Redundant communication refers to the replication of the same information, but with different media. This repeated information is redundant in a monocultural context, but helpful in a cross-cultural context to ensure that at least one information transfer is successful.

'Swift trust' is very common in virtual teams. It is a form of trust that is initially created and only later verified and potentially adjusted by individuals. Unlike other forms of trust, it is an affective 'leap of faith' (Möllering, 2001) and not based on positive previous experiences. Within a virtual team, swift trust can be created by ensuring early communication and a positive tone, which substantially influence the team's performance (Gilson, Maynard, Young, Vartiainen, & Hakonen, 2015).

3. Transnational Co-teaching Project

Our transnational co-teaching efforts are part of the project "INTENSE – INTernational ENtrepreneurship Skills Europe", supported as a strategic partnership under Erasmus+. Five partner universities (from Belgium, Croatia, Finland, Germany and the Netherlands) created a teaching team that redesigned their international management curricula. The output of the project includes comprehensive teaching materials that are complemented by a range of case studies, as well as a teaching manual with teaching scripts for lecturers. The project further includes the implementation of student consultancy projects that provide direct support to small and medium sized enterprises (SME) that seek to internationalise.

Initially, students are taught the basics of international management (e.g. market entry modes, strategies of internationalisation, cross-cultural differences) and project management in a regular single lecturer teaching environment at their respective home country. All HEI

involved in the project deploy the same teaching materials and scripts. Once the basics are known, lecturers make use of co-teaching to implement the real-life consultancy projects.

3.1. The Structure of Co-teaching in Student Consultancy Projects

The students work together in teams of five to seven students and each team collaborates with one local SME. The lecturers organised the collaboration with the SME beforehand. This includes the acquisition of potential partners and matching student teams and companies in home and host countries.

The projects start simultaneously in five countries, involve 25 student teams, 25 SME (5 per country) and require cooperation between student teams. Figure 1 illustrates how the transnational component is implemented in the projects using a simplified example of three teams.
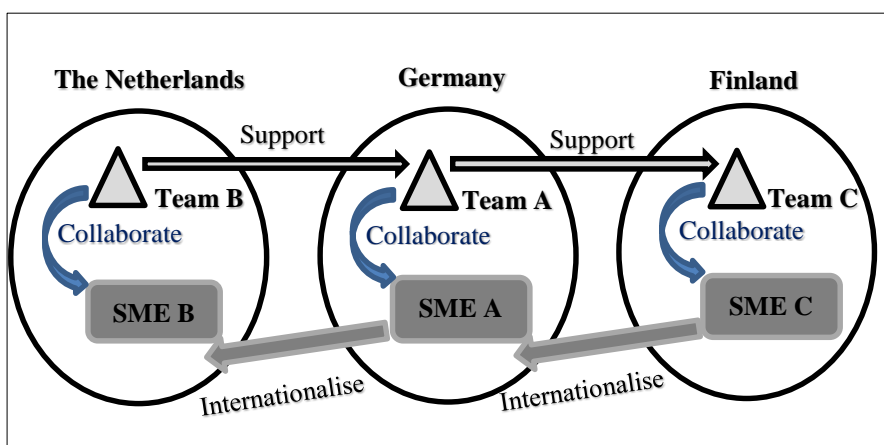
Figure 1. Transnational Student Consultancy. Source: Lehmann, Saulich and Wohlgemuth (2018)

Team A in Germany collaborates with the German SME A. SME A wants to internationalise to the Netherlands. Team A receives support from the Dutch student team B, e.g. relevant knowledge on the Dutch market. At the same time, team A provides specific information on the German market to team C. Team C is based in Finland and collaborates with the Finish SME C that seeks to internationalise to Germany (Lehmann et al., 2018).

The consultancy projects are supplemented by a course that follows a blended learning approach, meaning that some lectures take place as regular in-class lectures, while others were e-learning and individual counselling sessions. The course includes research skills, project management skills, behavioural skills, business etiquette and international management components. Course contents reflect students' needs and provide specific information just in time when students need them.

The involvement of lecturers and students from home and host countries ensures that students acquire the necessary market and task related knowledge that a single home country lecturer could not fully supply on its own. Moreover, this team learning provides students with a practical hands-on experience about the problems in intercultural and virtual communication and with insides on the real-life business problems of the firms they work with.

3.2. Regular Single Lecturer Teaching and Co-teaching

The INTENSE project offers the opportunity to evaluate the effectiveness of teaching in a regular single lecturer way and co-teaching since both methods are deployed in the project. The basics of international management and project management are taught in a regular way and only the consultancy project involves co-teaching and team-learning.

The reasons for this divide are various. Co-teaching requires a lot of additional effort (Vesikivi et al., forthcoming) and is not as efficient as single teaching (Austin, 2001). Therefore, it should only be implemented in cases where the added value is worth it and cannot be achieved otherwise (Wenzlaff et al., 2002). There is no need to rely on co-teaching for well-known theoretical concepts of internationalisation and project management. However, it is very valuable to add host/ home country collaboration if the content of the lecture is not standardised and ambiguous ad-hoc information is needed during the project.

As suggested by previous literature (e.g. Austin, 2001; Minett-Smith & Davis, forthcoming), we also agree that teachers should establish and maintain specific areas of expertise, although this is sometimes not fully implemented in practice. We tried to emphasise that the home country teacher should generally be in charge and the host country lecturers and students offer support. It is important to avoid ambiguity of who is in charge and what should be prioritised.

While students and lecturers later confirmed that multiple lecturers and team learning benefitted their learning, it created some frustration along the way and required additional effort. This is mainly due to differences in the organisation of HEI and differences in cross-cultural work behaviour. To provide examples: The workload expectations and the adherence to deadlines differed substantially and created a lot of misunderstandings between the teams. This was partly caused by varying academic calendars and course requirements across HEI. Resolving those situations early on and discussing the progress of both teams and the quality of their work regularly is crucial to avoid misunderstandings.

3.3. Virtual Team Collaborations and Teaching in a Single Physical Location

Team communication relies mainly on virtual distance media to reduce costs. The involved HEI could not afford regular team meetings across countries. However, the funding of the EU Erasmus+ programme allowed for one international student week in which 2-3 students (of 5-7 students) per project team could participate to exchange information face to face. The

week was scheduled in the middle of the projects. Therefore, it allowed to compare (1) the cooperation of the teams in a phase without any face to face contact (2) with direct contact in a physical space and (3) with virtual cooperation after an initial contact.

The first virtual work phase was characterised by a lot of misunderstandings and frustration. Particularly the cross-cultural differences complicate virtual communication. Students were free to choose the communication media. Various channels, such as e-mails, text messenger services, video-conferencing, phones, file sharing services etc. were used. As the literature (Tenzer & Pudelko, 2016) suggests, not all communication media were well perceived and the reliance on redundant information on various media helped the progress and the understanding. No specific medium is superior in all cases, but the diversity creates additional value.

The second work phase, the international student week in one single location, improved relations between most teams. While weak forms of trust were present in the initial communication, the direct evaluation of someone's ability, integrity and benevolence (Jarvenpaa & Leidner, 1998) led to a replacement of the initial swift trust by stronger forms of trust and distrust in the relationships. Most teams judged the others teams favourably in direct contact, which improved the collaboration in the third work phase, the virtual collaboration after the meeting. However, one team appeared less trustworthy than in virtual communication. This resulted in the opposite effect. Our experiences support previous work on 'swift trust' (Gilson et al., 2015) and the 'leap of faith' (Möllering, 2001) in virtual communication.

The synchronisation of progress in all countries also created organisational problems for co-teaching. During the distance work phases students and lecturers were still involved in additional modules at the home institutions that are not synchronised among the countries. The schedules were quite different (holidays, exam periods, etc.), therefore the time and effort invested into the programmes varied at different stages in every country, which created some slack for students in other countries that waited for input. These synchronisation problems do not exist in a single physical space teaching situation as all participants already arranged their schedules accordingly and reserved the appropriate amount of time. Our experiences support previous literature on distance learning that argues that virtual teams are more effective for asynchronous teaching than synchronous teaching (Bernard et al., 2004).

Overall, our experiences show that a combination of distance learning and face to face contact is beneficial. Distance learning helps to decrease costs significantly and is required by the nature of the project. However, at least one short face to face meeting creates a more realistic picture of your partnering team to justify the initial swift trust. In most cases it supports the efficiency of future work and communication. If a physical contact is not possible, a reliance on multiple communication media might be supportive to avoid miscommunication and build

at least weak swift trust. Lecturers and students need to take into account that virtual communication and building up trust in a virtual environment requires a high level of commitment and effort from all participants.

4. Discussion and Conclusion

Our paper adds to the practical dimension of teamwork and co-teaching in various ways. First, we illustrate a practical application of co-teaching and team-learning in a transnational setting. Lecturers in the field of international management or other international contexts might use our approach as a template to implement similar collaborations in their curricula. Next to the benefits that relate to co-teaching, the project also provides an interesting avenue to experience cross-cultural differences hands-on.

Second, we emphasise that co-teaching also involves a lot of organisational efforts and recommend its application only in cases were the additional co-teacher or expert can provide added value and the learning outcome cannot be achieved otherwise.

Third, lecturers from all fields might learn from our experiences with virtual collaboration and be motivated to apply electronic communication media. Many scholars regard a single physical location as necessary (e.g. Bacharach et al., 2008, p. 9). Our project does not confirm this, as virtual distance learning was in our case also effective. However, a combination of virtual cooperation and a face to face meeting is desirable.

Our findings and conclusions are currently based on two runs of the student consultancy projects. Further research on the impact of this teaching approach on students' innovative, team work, international, project management, and problem solving competences using the INCODE barometer is currently under way and might provide additional insights.

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Implementation of Game-based Learning in Higher Education: an example in HR Management

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Abstract

The benefits of game-based learning (GBL) are well justified in literature, but there are no abundant studies to its applications in different disciplines in Higher Education (HE). This method proposes a problem scenario within a play framework adding the elements of competition and chance. The main aim of this research is to describe and analyse the successful implementation of an application of a game-based learning in the subject of Human Resource Management (HRM) during the academic year 2018/2019. Students have had to face the resolution of a challenge in the field of HR proposed by a social enterprise. The activity, proposed as a competition, details also the student's perception by focus groups and surveys. The feedback collected shows that students positively assessed the new methodology and practical approach. The possibility of dealing with real organization's problems increments the student's motivation to learn. They consider that they have been able to acquire the core content of the selected topic by applying it in real situations. The empirical findings support the efficacy of game playing in HE and also shows that students enjoyed with this type of learning.

Keywords: Game-based learning; challenge; competition, HR Management; Higher Education.

1. Introduction

As Tham and Tham (2012) mentioned on their pilot study on Game-Based Learning (GBL) in Singapore, it has been proven that students born in the digital world are neurologically different to those students from previous generations. Due to the easiness of accessing internet and the global digital environment, students in the 21st century are provided with immediate information and feedback, and are always rewarded instantly for their efforts. This causes students to lose interest in traditional educational methods and prefer a more active and motivating methodology, rather than passively listening in class (Kenwright, 2016).

During the past years there has been an increasing concern about the students engagement in courses in Higher Education (HE), and awareness in the lack of students' motivation, achievements, attendance and participation has become a clear priority for educators (Nadolny & Halabi, 2016; Tham & Tham, 2012). Alternative teaching methods have been recently addressed by different authors with the objective of re-engaging students in HE (Ebner & Holzinger, 2007; Nadolny & Halabi, 2016).

Different studies have shown that learning with games provides a high variety of benefits (Tham & Tham, 2012). Using a GBL methodology has proven that students maintain a higher level of participation and enjoy this kind of learning; as well as increasing their attention span, improving collaboration and social interactions and encouraging a healthy competition (Ebner & Holzinger, 2007; Kenwright, 2016; Schmitz, Felicia, & Bignami, 2015)

Over the past two decades, there has been a high increase on lecturers' interest between games and education (Hwang & Wu, 2012; Kenwright, 2016). However, little evidence has been found of their application in HE or post-secondary level (Ebner & Holzinger, 2007; Wiggins, 2016).

The main aim of this research is to describe and analyse the successful implementation of an application of a GBL method in HE. This research explains the experience of a class activity in which students learn in a practical way how to define the work competences. Students have to define the general competences of a social enterprise and their assignment to each job description. This activity is part of the Teaching Innovation project awarded by the Fundacion Puig (B-SMART) where students are expected to work in the classroom on real business challenges. The experience reported took place at the Universitat Internacional de Catalunya during the academic year 2018/2019. Students participating in this project were enrolled in the Human Resource Management course, a compulsory subject included in the third year of the Degree in Business Administration.

2. Theorethical foundations

Although there are many definitions for GBL, a general and simple definition is the one provided by Wiggins (2016) in his study on the use of games, simulations, and gamification in HE. This study defines GBL as a type of learning in which actual games are used in the classroom to enhance learning and teaching.

When defining GBL, Ebner and Holzinger (2007) compared this methodology with problem-based learning. He stated that games include many characteristics of problem solving, i.e. an unknown outcome, multiple paths to a goal, construction of a problem context, collaboration in the case of multiple players etc., and they add the elements of competition and chance. On the other hand, Tham and Tham (2012), who analyzed the effectiveness of GBL as an instructional strategy for engaging and motivating students in HE in Singapore, adopted the following definition provided by Carson Learning Services (2006): Game-based learning is the process of taking an idea and creating an activity to deliver that idea in a manner that is motivating, challenging and fun, and has a measurable learning objective as a foundation.

GBL can often be confused with gamification. Although several authors use both terms interchangeably (Wiggins, 2016), Kenwright (2016) states that GBL is about the game and its cognitive residue, while gamification is about encouragement and the new technologies that stimulate this. When designing game solutions for the learning environment, there are different aspects to be considered. Although not all authors mention the same characteristics, they all mention similar fiels. For example, Kenwright (2016) in his study on GBL in HE, mentions the four part structures from Allen: (1) Context, (2) Challenge, (3) Action, and (4) Feedback; Nadolny and Halabi (2016) states that there are five characteristics that affect students' response to GBL methods, these are: (1) Playfulness, (2) Comparative pedagogy, (3) Instrumentalist, (4) Grade Status and (5) Performance; and finally, Tham and Tham (2012) mention the six characterisitcs according to Prensky (2001), that lead to a strong engagement of students on games: (1) rules, (2) goals/objectives, (3) outcomes/feedback, (4) conflict/competition/challenge/opposition, (5) interaction and (6) representation/story.

Although most authors differ on the exact definition for GBL, most authors agree on the fact that these games provide students with the possibility of solving real-life challenges and compromises within a safe environment and avoiding the fear of the real-world consequences (Ebner & Holzinger, 2007; Kenwright, 2016; Nadolny & Halabi, 2016). The main benefit of GBL has been identified as the students' engagement and motivation in the course (Ebner & Holzinger, 2007; Kenwright, 2016; Nadolny & Halabi, 2016; Wiggins, 2016). Nevertheless, different benefits have been observed in many studies: class attendance and participation (Nadolny & Halabi, 2016), creativity (Nadolny & Halabi,

2016), collaboration and social interactions (Schmitz et al., 2015) and others such as attention spam, mental flexibility, productivity, and healthy competition (Kenwright, 2016).

Finally, it is important to consider the dangers of this methodology. For instance, as Kenwright (2016) mentions in his study, when technology is used professors should consider the expertise their students have as it could become a barrier in the learning process. Also, GBL can be time-consuming both, when preparing the course and tracking the progress. GBL is only successful when solutions are well designed; limitations and challenges arise when the game has not been thought thoroughly and curricular objectives are not achieved, so it is important to plan carefully in order to achieve the academic objectives (Kenwright, 2016).

3. Description of the competition

The real challenge was proposed by SaóPrat. It is a non-profit, socio-educational entity, declared of public utility, which was born in 2004 in El Prat de Llobregat. The students had to prepare a report with the following information: (i) Catalogue of competencies according to the needs of the entity SAOPRAT. Build a list of competences (reduce to 15 transversal competences); (ii) definition of each competence; (iii) for each job, they must propose 4-5 transversal skills.

The 55 students enrolled in the subject were group in groups of 5/6 proposed by the lecturers (based on previous team-works). Creativity, justification of the choice of competencies and detail of the methodology followed were valued. During the group work, it was recommended to apply some element of design thinking methodology. Lecturers provided students the required material (Drive Folder with all the documents of the job description, organizational chart, etc), post-it, DIN 3 papers, etc.

One main session (2 hours) was carried out by the lecturers and the responsables of SaóPrat with the students. After this session, the students had to work in teams outside the classroom with the on-line support of the lecturers (on average a total of 16 hours per team). Approximately, 20% of the work was done during class hours, while the rest was performed after classes.

The grading of the work had a higher weighting than other work carried out during the course within the continuous evaluation grade. The work was be evaluated by the HR lecturers and the 3 best opted to make a final presentation in the social enterprise. The grades of the presentations were decided through a discussion among the two lecturers of the subject, who proceeded with the selection of the three best proposals (taking into account different criteria: structure, content and format). The oral presentation in the organization was assessed by the lecturesrs and the manager of SaóPrat. The mark of the

whole exercise (work + presentation) is considered the mark of the final exam of the subject, leaving these students free to take the final exam. International students who take the course first must take the exam in all cases. Lecturers consider that this assessment is motivating for students to work hard and achieve excellence results.

The lecturer's dedication changes when it comes to preparing this type of methodology. In the first place, the lecturer must know in depth the needs of the company and the problems to be solved in order to adapt them to the contents, level and demands that can be asked of the students. On the other hand, the role of the teacher changes. Instead of having an active position in the teaching process, he or she takes on the role of facilitator in this process. Finally, the teacher must reflect on the mechanisms for evaluating learning and the incentives (prizes) that must be established for the activity to be inspiring and attractive to students. Competition should be approached as something positive, in order to raise the score and not to penalize (Burguillo, 2010). In conclusion, this type of methodology affects the teacher's usual way (competition vs. traditional class).

4. Results and Discussion

During the day of the final exam and the final presentations, all students were given a survey to answer. The survey was made up of 23 statements grouped in five dimensions that had to be answered using a Likert scale from 1 to 5; one meaning the student totally disagreed with the statement and 5 meaning the student totally agreed. The first group of questions involved aspects related to competition. The second dimension covered aspects related to teamwork and collaboration, the third one analyzed the evaluation and knowledge acquired and the fourth compared the GBL methodology with traditional teaching. Finally, the last dimension included general questions about the course .

From the 55 students enrolled in the course 33 answers were obtained (out of 38, 86% of response rate) from those students that had to take the final exam and 16 answers (out of 17, 94,11% of response rate) from those students that did the final presentation.

The survey shows that those students who arrived to the final stage of the competition and presented their projects to the social enterprise, were more satisfied than those students who had to take the final exam.

Regarding the first dimension (competition), it is shown that the finalist students consider themselves more competitive. However, in general, both groups of students confirmed that the fact that the presentations were involved in a competition made them take it more seriously than if it had been a simple class presentation (mean of 3.67).

All students stated that this project has helped them improve the relationship between team members. Still, the three teams arriving to the final competition gave a higher mark to this

statement (3.36 vs. 4.16). This may be due to the fact that students not doing the final exam had to prepare the final presentation to be exposed at the social enterprise, having to work more hours together. This fact, together with the excellent quality of the work presented could also justify why students arriving to the final presentation tend to say that all team members worked equally (3.06 vs. 4.19).

When analyzing the evaluation dimension, in general, all students consider that the time dedicated to prepare this competition has been adequate to the weight it has in the course. Students taking the final exam think that they finish with more knowledge than those not taking it; this would explain why they think it is unfair for the winning students not to take the final test. However, these results could be biased by the students' perception of memorizing concepts for an exam. The final exam evaluated the topic in a very theoretical way, so the theoretical definitions were memorized much better by those students taking the test. However, it is important to notice that the practical knowledge and real-life experience were acquired by every student as they all confirmed to be engaged and motivated to win the competition by developing this practical case.

Comparing this teaching methodology to traditional learning all students confirmed that this activity was more time-consuming than a traditional lecture would have been (average of 3.90). However all students considered this activity much more dynamic than traditional learning (4.10) and that it made them feel more motivated to learn (3.67).

Finally, regarding the general aspects of the course, most students confirmed that this competition gave them a better understanding on the concepts of the course (3.71) as well as of the real problems of an enterprise (3.98) and how a company works (3.71). All students considered the activity useful (3.89) and were satisfied on how the activity took place (3.78).

Different focus groups were done with students to analyze in depth the results obtained on the surveys. In general, all the interviews confirmed the results previously explained.

All students said that the fact of the project being a competition between teams and not having to take the final exam, was an extra motivation for them to work harder and increase their interest and productivity.

Another interesting point mentioned by different students (both, those who had to take the final test and those who did not) found the instructions of the project and the initial material a little confusing. According to most of the students, there was too much material facilitated by the social enterprise and lots of time was needed to analyze and organize all the material.

Considering that professors of the course assigned each team member to a specific team, students had different opinions regarding this matter. Some students said that not all members worked equally and that they would rather choose their own team to avoid this

situation. However, other students mentioned that this gave them the opportunity to meet new people and as it was a team evaluation, all team members worked together to achieve the same goal (presenting their project to the social enterprise and not having to take the final exam).

Since the company involved in the projects had a social aim, some students felt more encouraged to excel on their work as they new they were helping a company with fewer resources.

Finally, one of the the points that was most brought up by students was the fact of having a real life experience. Dealing with real company problems helped students understand better how a real HR department works. Students stated that although it was more time-consuming than a traditional course, they enjoyed it more and found it dynamic and interactive.

When they were asked about how to improve the course, students suggested that more work could have been done during course hours instead of after class and that a presentation could have been done halfway through the course to make sure teams were moving in the right direction.

5. Conclusions

The main aim of this research was to analyze the implementation of GBL in the subject of Human Resource Management (HRM) during the academic year 2018/2019.

As mentioned earlier, surveys confirmed that this approach gave students a better understanding on the concepts of the course (average of 3.71 out of 5) as well as of the real problems of a company (3.98) and how a company really works (3.71). Finally, all students considered the activity useful (3.89) and were satisfied on how the activity took place (3.78).

The focus groups enphasyzed on the fact that the game was presented as a competition and according to students, this motivated them to work harder and enjoy the project. This confirms the findings of Tham and Tham (2012) on their study on the effectiveness of GBL as an instructional strategy for engaging and motivating students in HE in Singapore.

Regarding future research, the impact of the students' nationality could be analyzed. Students enrolled in this course were both, Spanish and international students (mainly italian). Findings show that Italian students, in general, found this project more innovative and entertaining than those from Spain. Also, out of the 17 finalist students, only three were Spanish, suggesting maybe that they this methodology has different effects depending on the different educational backgrounds.

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Seasonal Capacity Scaling and Learning Centres

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Abstract

Danish politicians' interest in using higher education institutions (HEIs) as policy instruments in regional development initiatives has increased significantly in recent years. Recent initiatives include the establishment of regional learning centres and study stations. This article has two overall research objectives. The first objective is to discuss the use of regional learning centres and study stations and to discuss an overall conceptual framework for the establishment and running of physical and virtual learning centres or study stations. The second objective is to discuss the use of seasonal capacity scaling in the educational sector. The discussion is based on a concrete case from a regional area of Denmark supplemented with interviews of both students, teachers and programme managers. Our research shows that seasonal capacity scaling of educational offerings based on a combined physical and virtual framework may be beneficial when establishing and running learning centres or study stations.

Keywords: *Learning centre; study station; scaffolding; seasonal capacity scaling.*

1. Introduction

In recent years, there has been an increasing interest in using HEIs as policy instruments in regional development initiatives. Recent studies have shown that young adults situated in rural areas relocate themselves in order to obtain a degree from a HEI, however, they often decide not to return to their place of birth, cf. Hansen (2014) and Larsen (2017). This is problematic as companies in rural areas may find it difficult to attract skilled labour, which may lead to a stagnation in growth for said companies, cf. OECD (2017).

2. Case Description & Methodology

In this section of our paper, we will outline our case study and our methodological considerations. Our case is Skjern, which is one of the main cities in Ringkøbing-Skjern Municipality, which geographically speaking is the largest municipality in Denmark. Ringkøbing-Skjern Municipality is located on the west coast of Denmark with the North Sea as a main attraction for the thousands of tourists who visit the area each year. Tourism is one of the main drivers of value creation in Ringkøbing-Skjern Municipality, with 7.4% of the value created coming from the tourism and hospitality industry. This is significantly above the average in Denmark, which only is 3.2%, cf. VisitDenmark (2017). The tourism and hospitality industry is therefore important for the continuing development of Ringkøbing-Skjern Municipality. The destination of Ringkøbing-Skjern has experienced growth in recent years, and this growth is expected to continue in the coming years. This calls for an "educational upgrade" of the existing and the future labour force, if SMEs within the destination should experience the full benefits of future growth. The methodology is a concrete case from a regional area of Denmark supplemented with interview data from interviews with decision makers, students, teachers and programme managers.

3. Learning Centres and Study Stations

In this section of our paper, we will outline existing definitions and theoretical considerations on learning centers and study stations. First, we will define and discuss the term 'learning centres'. The term 'learning centre' is complex in nature, and existing literature contains different understandings and different definitions. One definition of 'learning centres' in Scandinavia uses four design principles on learning centres as follows, cf. Petersen et al. (2016):

a) A learning centre is a physical location, where citizens can meet other citizens who also wish to study. A learning centre does not comprise an online platform or an online education portal only.

b) A learning centre connects to education institutions through digital couplings. These couplings may take different forms, including synchronous telepresence or asynchronous learning platforms. The central premise is that the couplings connect the learning centre to one or more education institutions.

c) Teaching at a learning centre takes place through the digital couplings described above. That is, the teachers are not physically present at the learning centre, but various resource staff members may work there, such as mentors, career counselors and technical assistants.

d) A learning centre is rooted in the local community and owned by the municipality. This means that the municipality is in charge of running the learning centre, whereas the education institutions are responsible for offering courses by connecting digitally to the learning centre. The municipality defines the objectives and the design of the learning centre as well as the facilities available.

This definition was very useful, because it enabled us to develop our own model. Petersen et al. (2016) base their definition on the 3M functions originally suggested by Grepperud & Thomsen (2001). The 3M functions can be used as a general design framework for learning centres and these functions are a Motor, a Mediator and a Meeting Place. The Motor means that a regional learning center may act as an organizational motor for local development, the Mediator function means that the local learning center in fact is a mediating factor between local demand for competencies and educational needs. Finally, the Meeting Place means that the learning center is both a physical and a virtual place, in which students, teachers and mentors meet. Establishing a good relationship between students and especially teachers is important, as it affects students' successful study progress, cf. Hagenauera & Voletb (2014). Therefore, the Meeting Place and how it enables students and teachers to interact with each other and build relationships are of great importance.

Second, we will define and discuss the term 'study stations'. According to a Ministerial Order, cf. UFM (2018) by the Danish Ministry of Higher Education and Science and a number of other orders by the Ministry, a study station may be described *as an opportunity for Danish University Colleges and Business Academies to place (or distribute) educational offerings in areas, where the provision of educational offerings is low and the demand for specially trained labour is high*, cf. UFM (2018).

Study stations thus seem to be much more embedded in the local business community and offer an interesting opportunity for HEIs and municipalities to educate and retain talents in rural areas of Denmark. There are a number of learning centres in Denmark already, for example HUSC, cf. Kristiansen (2018), which is a learning centre rooted in the local community and owned by the municipality, cf. item D in Petersen et al. (2016). HUSC may thus be characterized as a learning center with an active mediator.

4. Conceptual Framework and Discussion

In this section, we will outline and discuss our conceptual framework for physical and virtual learning centres & study stations, because we believe that innovation in this area is needed. We have based our framework on the literature discussed and on our case. Our framework presents a new and alternative view on learning centres and study stations. Our framework includes considerations on the correlation between the student, the learning objectives, the study activities, the learning activities, the scaffolding activities and the role of the stakeholders. We have developed the following model shown Figure 1, which illustrates our framework.
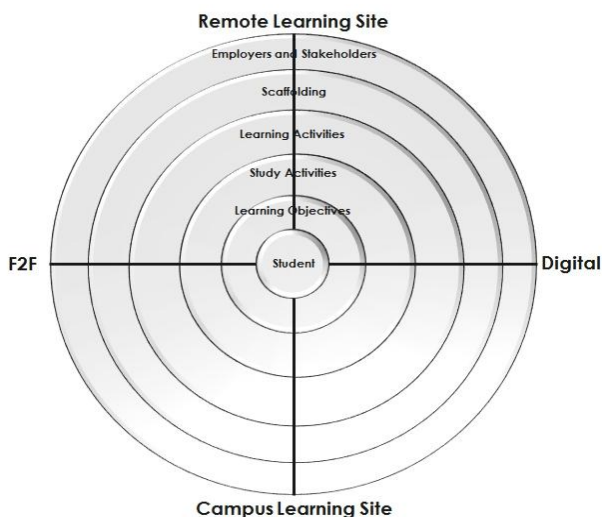
Figure 1. Model on learning centres and study stations

The model above takes its starting point in two scales. When setting up a learning centre or study station, it is first recommended to consider the horizontal continuum between F2F learning, i.e. conventional classroom teaching and digitally supported learning, i.e. learning by means of online learning activities. In our opinion, it is important to consider how the learning centre in question should be placed on this blended learning scale, and perhaps even more important how the two approaches can support the student and his/hers learning objectives. Second, the vertical scale between campus learning, i.e. when learning primarily takes place on a campus and a remote learning site, i.e. where learning takes place at home, in the train, in the workplace etc. We argue that the conceptual framework developed here will successfully facilitate most decisions in the design phase of any learning center or study station. The framework applies for both physical and virtual learning centres and study stations and as such, we do not distinguish between the two, because we see them as fully

integrated. In our framework, the student thus has access to both a physical and a virtual learning centre or study station thus enabling the student to learn anytime and anywhere.

Furthermore, our model also encompasses a number of other considerations. At the center of the onion-like model is the student, i.e. we must base our learning design on an in-depth analysis of the student characteristics in order to cater for the needs of this particular student in the best possible way. Obviously, this is closely linked to the next layer in our model, which is the learning objectives. Without clear learning objectives, it is very difficult to develop successful learning designs. The third layer is the study types, i.e. *Acquisition, Collaboration, Discussion, Investigation, Practice or Production*, which are part of the Arena Blended Connected Curriculum Design, cf. Perovic (2015). The fourth layer is the learning activities. Learning activities are the concrete activities (either F2F or digital) that teachers plan to carry out with the students in order to reach the learning objectives. The fifth layer is scaffolding, i.e. the types of support activities and support structures that are required to scaffold the students and the teachers in question.

Based on our case study this is particularly important because learning centre and study station students naturally need scaffolding to be able to study from a learning centre or study station. We recommend an active mediator, cf. also Hattinger et al. (2007) and we recommend that the learning centre or study station in question should be supported by receptionists, mentors or at least teaching assistants, because it is an effective way to support rural learners. In other words, human scaffolding is an important element. The final and sixth layer is the employers and/or stakeholders. The local employers and stakeholders are crucial for the success of learning centres and study stations. Local employers should be involved as natural co-creators in the learning activities in the learning centre or study station in question as they also hire the students when they graduate. Furthermore, the involvement of local employers and stakeholders ensures continued relevance of the supplied education. Local anchorage and involvement of local decision-makers are crucial for success.

When setting up a learning centre or study station we also suggest that a seasonal capacity scaling approach is used. Our model on seasonal capacity scaling in education is shown in Figure 2 below.
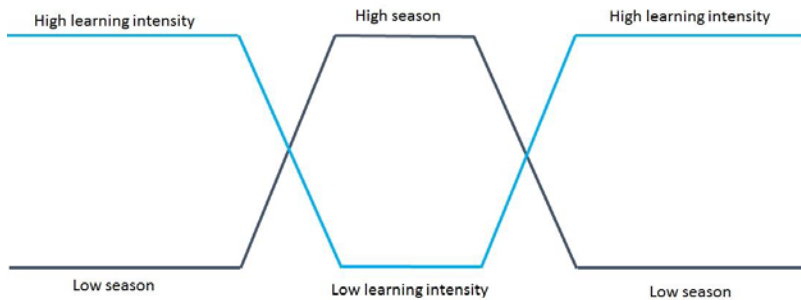
Figure 2. Model on seasonal capacity scaling in education

The seasonal capacity scaling model is based on four design principles. The first underlying principles in our model is that we want to supply education to the right type of students, in the right geographical area, at the right time and at the right amount and quality. Another underlying principle in our model is that we want to design educational offerings that are fully integrated with a specific industry (in our case the tourism and hospitality industry) in a specific region (in our case Ringkøbing-Skjern). The third underlying principle in our model is that we want to design cost-effective educational offerings, which fully utilize the financial benefits of seasonal capacity scaling. The fourth underlying principle in our model is that we want to design educational offerings, which successfully support the regional stakeholders by allowing students to work full time during high season (in the Danish tourism and hospitality industry peak season is May-August). Interview person 3, who is a representative from the Confederation of Danish Industry strongly supports this model and says *"this would be very interesting for our members, especially in the service industry and I think that it would be a good idea especially in continuing education"*. This means that we have developed a model, which calls for a flexible educational offering, where learning intensity is high when the related industry in question is in low season and vice versa. As seen in Figure 2 above, we propose a flexible form of study, which allows students to work full-time in a period of four months during high season in the industry in question (in this case the tourism and hospitality industry) and when the industry is in low season the formal learning intensity at the learning center or study station is increased. This is in fact supported by interview person 1, who is a student. He says that *"I think it would be a very good idea to learn more during off season and then use your new knowledge during peak season. I would in fact also be willing to be enrolled in such a programme even though the total study length would be longer. So I would not mind a longer study period"* when asked about the seasonal capacity scaling model.

The idea of using a seasonal capacity scaling model is also supported by interview person 2, who is an educational expert from one of Denmark's largest unions. She says *"it does make*

sense in a Life Long Learning perspective and especially in continuing education. However, I do not think that it works in traditional full time programmes".

By accommodating the need for labour during peak season, local stakeholders should support the idea of providing education that may benefit said stakeholders in the future, as a better educated labour force will create more value. Furthermore, this flexible approach to formal education makes education much more practice-relevant for the students and it is in fact also an economic approach to educational provision. Education is hard business and the fixed costs are high, no matter how many students the HEI in question has in each class. Therefore, HEIs need to design for full capacity utilization where some programmes have high learning intensity in periods where other programmes have low learning intensity.

Based on our case and on the basis of our research developing this framework, we believe that the advantages or gains of using this framework are considerable. We argue that our framework would mark the beginning of a new era in the Danish educational sector, because it would be a considerable gain for the local industry, the local students, the local economy, the HEIs and the societal cohesion of the Danish society. Furthermore, we also find that when educational offerings are integrated in the local community and in the local business, important innovation is facilitated and often such collaboration leads to professional clusters.

5. Conclusions

This article discussed a conceptual framework for learning centres and study stations. The conceptual framework consisted of two models; one on learning centres and study stations, and one on seasonal capacity scaling of education. Our discussion was based on a specific case from Rinkøbing-Skjern and five interviews with both decision-makers, students, teachers and programme managers. Based on the analysis we argue that the framework developed is applicable to a case such as Ringkøbing-Skjern and based on our data we believe that our framework is indeed beneficial when designing, implementing and running regional learning centers and study stations. We argue that our model on learning centres and study stations addresses some of the most important considerations, because it encompasses several important considerations such as the student, the learning objectives, the study activities, the learning activities, the scaffolding of both teachers and users and the role of the employers and the stakeholders.

Based on the analysis we also argue that our framework enables students in the tourism and hospitality industry to earn a degree while at the same time meeting the employers' demand for high season employment, because the framework developed uses a seasonal capacity scaling approach allowing students to work full-time in high season and study full-time in low season. We argue that the seasonal capacity scaling model is a huge step in the right direction, because learning should in fact be more in sync with the regional industry in

question. Additional research in related areas such as for example, time scaling, area scaling, curriculum scaling, platform scaling and network scaling is very much needed in times of disruption in the educational sector.

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Adapting conventional delivery to cope with large cohorts: turning seminars into workshops and changing assessment

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Abstract

Teaching a popular postgraduate political economy module to around 50 international business and environment students (mainly Chinese) had always gone well. Delivery consisted of lectures and seminars with assessment via a 3,000-word essay. But with a three times larger cohort in 2017 things went wrong. The response from the teaching team was twofold. First to replace seminars with team-taught 2-hour workshops, to provide fewer targeted readings accompanied by specific questions for groups to answer, plus a redesign of the assessment, introducing a shorter more issue-specific approach based on short (500-word) answers to five questions chosen from ten, all tied to module learning outcomes and content. How did all this go? The paper highlights problems with the traditional approach and offers an initial evaluation of the changes introduced in 2018. Ultimately the paper addresses the strengths and weaknesses of the before and after and relates this to the changing demands placed on tutors charged with teaching large cohorts in a department going through rapid expansion. The case highlights the critical balance between volume and quality and asks difficult questions about the student experience and how universities respond to an increasingly marketized higher education sector.

Keywords: lectures; seminars; workshops; assessment; marketisation; student experience.

1. Introduction – why things are as they are

This paper confronts a critical challenge facing universities and even within single departments experiencing rapid growth in an era of marketisation that is bringing dramatic change to the higher education sector (Jongloed, 2003; Brown and Carasso, 2013). Marketization means reliance on income from student fees, especially higher paying international students, and an environment in which universities' autonomy means operating in a commercially competitive environment within which some departments may be deemed not viable while others are substantial revenue earners. The importance of secure income streams from teaching has commercialised the sector (Molesworth, et al, 2009, 2011; Collini, 2011; Nixon, et al. 2016). Government extolls the economic benefits of higher education above educational or cultural values (HM Government, 2011; Warner, 2015). For some years now and especially since the Browne Review into Higher Education (HM Government, 2010), there has been an emphasis on objectives around employment, investment, and competitiveness. Education is required to articulate with the Neoliberal ideology that drives contemporary economic globalisation (Lynch, 2006; Gray, 2010). At all levels education also appears to degrade creativity in its obsession with outcomes and qualifications, as Sir Ken Robinson famously claimed more than a decade ago (Robinson, 2006). He was talking about schools, but much of higher education reflects the same process.

Students have become consumers of a product in a process of commodification that has fuelled competition and rivalry between institutions including new private providers (HM Government, 2016). While many academics interpret internationalization as comprising mobility across borders, collaborative research, sharing cultural capital and appreciating the value of diversity and cosmopolitanism as a public good (Knight, 1994, 2003; Fielden, 2007; Sweeney, 2012) university accountants and financial controllers see internationalization strategies as primarily about attracting more overseas students and research grants from abroad. HEIs focus recruitment on lucrative markets such as China, India and the Gulf. This is relevant to the case reported in this article, because the module concerned is taught in a School that fits the marketisation/commodification thesis.

The case reported here describes direct experience regarding one module in a UK Russell Group institution where the management/business school provides significant income from postgraduate courses, income which serves to subsidise other departments with much smaller intake of overseas students. This is a common situation in many universities. International students make up a high proportion of postgraduate fees income, especially in certain disciplines: business and management foremost among these.

The paper begins with a brief discussion concerning student engagement (SE) and how even this has become a contested concept. I will then present a case study involving a single module on international political economy and business, taught in York Management School. The experience of teaching this module exposes the pressures on academics to conform to institutional and government expectations regarding how we teach and how we undertake assessment. It is therefore of clear importance to pedagogy and relevant to the professional rewards that academics have a right to expect given their commitment to their disciplines and to their students.

The article outlines changes brought to the module and discusses observations based on evidence regarding the impact of these changes. The conclusion presents a damning indictment of the direction of travel in how academics are obliged to respond to the expectations of institutional management and administration. It is unfortunate that the experience outlined in this case exerts a dispiritingly negative impact on the student experience and staff morale.

2. Student engagement

The term student engagement has emerged relatively recently in education debates but is widely deployed in QAA, HEA, Universities UK and in pedagogy literature (Higher Education Academy, 2015; Trowler, 2010; Anyangwe, 2011; Christenson, et al, 2012; Kahu, 2011; Milburn and Shaw, 2017; NSSE, 2013; Sweeney, 2018). This follows a substantial literature around student centred learning (Lea, et al, 2003; Barraket, 2005; Mazur, 1997; Kumar, 2007; Independent Education Today, 2015; Leuven Communiqué, 2009). However, Milburn and Shaw point out that the term lacks any clear definition and its somewhat nebulous character has become embroiled in an instrumental approach to achieving learning outcomes around 'skills development, knowledge acquisition, employability, retention, grades and graduation' (Milburn and Shaw, 2017:54). SE is reduced to measurable outcomes in a process that reflects universities being viewed increasingly as training and accreditation institutions, away from the classical understanding of their centrality in the pursuit of knowledge and understanding through blue sky thinking and reflective analysis. Milburn and Shaw posit two contrasting ways of understanding student engagement:

1. SE as a set of measurable outcomes such as grade point average, degree classification, class attendance and student retention.

2. SE as a difficult-to-measure, holistic and abstract transition that students undergo throughout their HE career (Milburn and Shaw, 2017:54).

I describe the latter as 'positive student engagement' (Sweeney, 2018:256). Positive student engagement values a cognitive-emotional commitment to a wide range of contextual attributes associated with students' own cultural capital and that of others (Bourdieu, 1980). It supports teaching and learning strategies that depend not only on student-centred learning but on eliciting responses to situations and themes which bring emotional connections to students' experience, their interests and their prospective futures. What matters more than the end-point of study and the award of certification is the process through which students become active lifelong learners able to bring critical and analytical skills to addressing societal concerns. These aspirations ought to underpin the teaching and learning process but in an increasingly competitive, mechanistic, instrumental and measured environment where the type-1 above holds a dominant position, the idealism of type-2 seems quaint and unattainable. It is clear too that for students the transformation of the university experience extends to their own priorities being the result: the degree and its classification are the primary if not the sole purpose of going to university. This is probably especially true for parents and sponsors paying the fees. The degree after all is literally marketed and sold as providing the vital route into a rewarding career with pay and perquisites to match.

We turn now to evidence from a module in my university, experience which encapsulates difficulties facing staff needing to confront not untypical challenges in today's universities.

3. Case study: it wasn't broke, then it was, then what happened?

The module International Political Economy and Business has long been a core autumn term module in MSc International Business and Strategic Management at The York Management School (TYMS). It was always very popular, achieving high evaluation scores and extremely positive qualitative comments from students, many of whom had never encountered a module so heavily rooted in politics and political theory, in this case International Political Economy (IPE) and International Relations (IR) theory. The module lays down theory in the opening weeks before presenting critical analysis of leading international institutions and a broadly neo-Marxian critique of Neoliberalism, viewed as the driving ideology of contemporary economic globalisation. The core text is the widely used standard introduction to IR, *The Globalisation of World Politics* (Baylis, Smith and Owens (eds.), OUP 2017).

During a 2016 review of the postgraduate offer in the School, the module was added to the core diet of MSc Management and to two new programmes MSc International Business and MSc International Strategic Management. Every year it also attracts students from MSc Corporate Social Responsibility and Environmental Management, run jointly between Management and the Environment Department. These students add high value to the teaching and learning experience as they hail from various countries adding to cohort

diversity. They also tend to be well informed and vocal, contributing significantly to class discussions.

Until the 2017 intake around 70 per cent of the usual cohort of between 40 and 60 students on the module came from the Peoples Republic of China (PRC). The other 30 per cent tended to be highly diverse, with often fifteen different countries represented. This added to the enjoyment of teaching this module and no doubt contributed to positive student engagement. A significant number also came from various European Union countries. These too tended to be vocal contributors to class discussions. The style of teaching always involved high levels of student participation, not only in seminars, but also in lectures designed to be as interactive as possible, usually including discussion of contemporary news events.

In 2017-18 the module for the first time took in 85 MSc Management students, the great majority from PRC. This coincided with rapid expansion in the School. There was an alarming fall in the average mark for the assessment (see Table 1). The assessment had consisted of a 3,000-word essay that tested learning of core content from across the module, with the best performing students showing a good level of critical analysis and understanding of theory. Students could choose between two alternative titles. The average score for several years was consistently around 60-61 per cent, just inside 'Merit' category. In 2017 this tumbled to 51 and in a much larger cohort almost half the students failed to reach the pass mark of 50 per cent at M-level. At the top end, as in previous years there were some high performing students producing distinction standard essays, around 10 per cent of the cohort.

The teaching team noticed a marked deterioration in student participation in seminars. This was only partly in terms of attendance, being more a question of students poor preparation and not contributing to discussions. In former years seminars had 10-15 students and never more than 20. In 2017 the average seminar size was often over 20. Tutors noted that many students appeared reluctant to engage, did not contribute and were poorly prepared.

The teaching team discussed these symptoms of declining performance and wanted to address these in ways that could achieve better results, promote better participation and improve student engagement (SE). Several steps were taken to arrest the decline, including:

1. **Structural change**. We abandoned weekly seminars, having Workshops in Weeks 3, 5, 7, 9 and 10 instead. This change was motivated by poor participation in seminars, including tendency for some students to free ride on others having done the preparation. The seminars had grown too large. We decided to switch to workshops with 30-40 students in each Workshop. We divided the students into self-selecting groups of seven or eight, and these groups would work together throughout the course over the nine-week period. The Workshops being

fortnightly meant students had more time to prepare. Work was set and publicised in the lectures and on the Virtual Learning Platform at least a week before the scheduled Workshops.

2. **Rotating tutors**. We introduced a system of three tutors, the module leader delivering most of the weekly lectures and the Workshops delivered on a rotational basis by different tutors for each session. This meant all students saw all three tutors in their workshop at least once.

3. **Workshops**, each of two hours in large rooms with flexible seating, were carefully planned with set questions linked to readings, around a dozen TRUE/FALSE statements summarising key issues and allowing for discussion and a couple of group presentations from students on a pre-indicated topic. The rest of each workshop consisted of discussion with answers to questions elicited from the various groups.

4. **Lectures** remained unchanged – 9 weekly 2-hour lectures on Monday preceding Thursday Workshops. They were always highly interactive and supported by PowerPoint slides, subsequently placed on the Virtual Learning Platform with additional content elicited from students during the sessions, Summary audio accompaniment is added. The slides consist of headline topics with 15-20 slides per lecture, bullet points, pictures or diagrams, but not much text. The slides support the lecture, they are not the lecture content.

5. **Workshop preparation**. We shortened the reading burden. We used targeted readings and provided accompanying worksheets with specific seminar questions related to the specific readings - usually extracts from a book, a chapter from the course book, or news articles or commentaries from the *Economist* or *Financial Times*. Worksheets included TRUE/FALSE exercises, What/Why or How type questions, and instructions on preparing a group presentation. We encouraged students to work in their groups to prepare for the Workshops.

6. **Assessment**. We abandoned the 3,000-word single essay, introducing instead a 10-question summative assessment, released in Week 7. Students choose five questions to write short answers of around 500-words each, total assignment length 2,500 words +/- 10%. Answers should show familiarity module readings, workshop material, and the course book. We required a single list of references. Students had six weeks to complete the work, run it through Turnitin and make an electronic, anonymised submission.

We included a **formative assessment** in Week 8 or 9 whereby students could electronically submit a single page outline of two of their five answers, indicating a basic structure or key bullet points, and identify relevant literature. All students undertook this formative assessment. The final Workshop and half of the final lecture was dedicated to feedback on the formatives although all students received individual electronic feedback as well.

3.1. The outcome – results of the changes

Structural changes and students' module evaluations

Student evaluations of the module – conducted electronically in Week 10 – were positive and comparable with previous years. Students enjoy this module and like how it is delivered. They also profess to find the content interesting and stimulating, according to informal responses, electronic quantitative and qualitative evaluation and reports from Student Representatives to the termly Staff Student Liaison Committee (SSLC). Significantly, students reported finding the workshops rewarding and enjoyable.

We consider the switch to Workshops a success, with better attendance, more participation and a general buzz around the workshops that the seminars had often lacked, especially in 2017. In SSLC we heard that the two-hour workshops gave students more time to prepare, and time was more efficiently spent in a two-hour fortnightly class than in weekly one-hour seminars. Student Representatives suggested the Workshop model be used in other modules.

The more targeted readings were effective and students more regularly got to present findings in the workshops. We felt optimistic about a good level of learning across the cohort.

3.2. Assessment results

Many formative assessments were rather poor. Students struggled to follow instructions. We responded by devoting the final week to feedback and guidance for the assessment. Students could ask questions and we gave clear directions on how to answer the questions as set.

Unfortunately, the final assessments were no better than the 2018 essays (see Table 1). This is disappointing as we felt the five-question format was easier. It is a ghastly phrase, but we think we had 'dumbed-down' the assessment. The 500-word answers allow students to display basic content knowledge and learning from across the module, but there is less scope to shine with critical comment or analysis of underlying issues. Despite this the best students managed this to some degree and around ten percent achieved top marks. However, the cohort average remained 51 percent, no improvement and a very disappointing outcome.

Table 1: Comparison of marks following increased cohort size: note decline in percentages achieving highest marks, increase in fails, and fall in median/average scores after 2017.

2018/19				
# of students	**Mark range**	**Median**	**Average**	**St. Dev.**
196	10-90	52	51	15.65
Distinction	**Merit 60-69**	**Pass 50-59**	**Fail 40-49**	**Fail <40**
18 (9%)	49 (25%)	50 (26%)	39 (20%)	40 (20%)
2017/18				
# of students	**Mark range**	**Median**	**Average**	**St. Dev.**
130	0-88	52	52	16.74
Distinction	**Merit 60-69**	**Pass 50-59**	**Fail 40-49**	**Fail <40**
18 (14%)	24 (18%)	42 (32%)	24 (18%)	22 (18%)
2016/17				
# of students	**Mark range**	**Median**	**Average**	**St. Dev.**
36	30-90	60	60	16.38
Distinction	**Merit 60-69**	**Pass 50-59**	**Fail 40-49**	**Fail <40**
16 (44%)	3 (8%)	5 (14%)	9 (25%)	3 (8%)
2015/16				
# of students	**Mark range**	**Median**	**Average**	**St. Dev.**
40	28-88	62	61	13.95
Distinction	**Merit 60-69**	**Pass 50-59**	**Fail 40-49**	**Fail <40**
10 (25%)	13 (33%)	10 (25%)	4 (10%)	3 (7%)
2014/15				
# of students	**Mark range**	**Median**	**Average**	**St. Dev.**
64	10-85	59	57	14.67
Distinction	**Merit 60-69**	**Pass 50-59**	**Fail 40-49**	**Fail <40**
14 (22%)	18 (28%)	18 (28%)	8 (13%)	6 (9%)

4. Conclusion

The results did not improve even if the teaching and learning experience had felt better than in 2018. We think the 500-word format may disadvantage good and very good students as they have less scope to show deeper learning and critical analysis than in a 3,000-word essay. Some managed this, but the truth is that the new format works to show basic content knowledge, but is less good at bringing out creativity and critical analysis.

We might have accepted this bargain had results at the bottom end been better but this was not the case. The same low average mark was a disappointment. A large number of students simply did not making the grade, not performing at Master's level. They will undertake resits in August by which time they may have adjusted to the demands of the programme and of the university. Significantly, other modules also show marked deterioration in performance.

Further analysis is required at an institutional level to make a well-informed judgement on the underlying causes of poor student performance. We suspect the decline is due to cohort expansion and the channels the university uses for recruitment. These are questions many HEIs need to confront in an honest and comprehensive debate about standards.

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Evaluation of learning communities: principles to guide practice

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Abstract

The aim of this paper is to evaluate the implementation of extra-curricular learning communities (LCs) that are open for all students at the faculty of Economics and Business. The LCs were developed using established guiding principles that included the choice of the theme, the educational concept, and the scheduling. During 5 semesters, 37 LCs, of which 17 unique LCs, were executed. According to the guiding priniciples, the themes extended beyond themes of regular courses and attracted both BSc and MSc students from different degree programs. Furthermore, the theme enhanced students' professional preparation and employability. The combination of insight from practice with theory was positively evaluated. Despite the guiding principle, half of the LCs were topic-based instead of project-based. Since students strongly agreed that all LCs were a good learning experience, we have modified this guiding principle. Most points of improvement given by the students concerned the scheduling. They missed the structure they have during regular courses. Especially in the beginning of the LC they want to have more meetings to get a head start. Overall, great commitment of lecturers as well as students led to a successful realisation of these multi-disciplinary, extra-curricular and multi-level LCs.

Keywords: Learning Communities; Higher Education; Student-centered Learning; Extra-curricular Activity; Employability

1. Introduction

The increased number of students in higher education institutions leads to large classes with less contact between the lecturers and the students. Furthermore, students can feel lost and anonymous. To create a sense of belonging, the learning community (LC) as educational format receives a lot of attention by higher education institutions. Though many forms and definitions of LCs exist, they do have some common academic and social features. A LC should be a joint enterprise that binds members together into a social entity (Wenger, 2000). Most LCs incorporate active and collaborative learning activities. Active learning means student-centered learning. Students need to actively construct and assimilate knowledge. Herewith the focus of instruction shifts from the lecturer to the students. Collaborative learning implies a social emphasis on learning. This peer learning and interaction allow the development of complex ways of thinking so that students learn at a deeper level and move to higher levels of intellectual and psychological development (Bransford et al., 2000; Lave & Wenger, 1994). This is based on Vygotsky's (1978) social constructive theory. By interaction with peers from different cultural and disciplinary backgrounds a disequilibrium is introduced that sets the stage for students to get in contact with different perspectives. This disequilibrium can also be threatening and confronting (Hoban, 1999), but this can be addressed through mutuality, meaning students of the LC are in a similar position and have a common goal (Lee & Boud, 2003).

The aim of this paper is to evaluate the implementation of extra-curricular LCs that are open for all BSc and MSc students at the faculty of Economics and Business. The LCs were developed using established guiding principles (see section 2). The questions we want to answer are:

1. Which guiding principles are actually implemented in the LCs?
2. How do students evaluate the LCs?

In section 3, the description of the data collection and analysis is given. The characteristics of the implemented LC and the participating students is given in section 4. This section also includes the results of the students' evaluation. In section 5, the discrepancy between the guiding principles and the characteristics of the implemented LCs will be discussed.

2. Implementation of learning communities: guiding principles on paper

2.1. Context

The LCs are implemented at the faculty of Economics and Business (FEB) of the University of Groningen, the Netherlands. FEB's educational portfolio consists of four broad bachelor's degree programs, twelve specialised master's degree programs, and one research master program. Yearly, the total number of students is around 6700. The LCs are

part of the activities of the department FEB Careers Services to strengthen students' professional preparation and increase graduates' employability.

2.2. Guiding principles

To create additional learning activities to strengthen students' professional preparation and increase graduates' employability, FEB has developed a concept for extra-curricular, multi-level and multi-discipline LCs. Extra-curricular means that students do not receive credits that contribute to their degree program, but receive a certificate for participation. As such, students from BSc as well as MSc level and multi-disciplines can enter one LC. This situation is not facilitated within regular courses of a degree program. The LCs at FEB are student-type learning communities, specially designed for targeted groups with a similar academic interest (Lenning and Ebbers, 1999). The guiding principles include the choice of the theme, the educational concept, and the scheduling. The theme for such a LC should attract both BSc and MSc students from different degree programs, thereby using their own and each other's competences. In addition, the theme should enhance and strengthen the societal and employability awareness experience using real life challenges as the core activity of the LC. Furthermore, the theme should extend beyond themes of regular courses. This is possible, since the LC is extra-curricular. This gives the lecturer the opportunity to address any topic of interest that cannot be addressed in regular courses of a degree program.

The educational concept of the LC is project-based learning, a popular approach in business education (Smith & Gibson, 2016). To participate in a LC, students need to hand in a motivation letter. The lecturer will initiate the LC by inviting students and introducing them to the problem or assignment and gives them directions. Preferably, the project is commissioned by a client from a company, resulting in an authentic learning experience. From then on, students are in charge of the project under supervision of the lecturer. Depending on the project, students will formulate the problem, gather knowledge through e.g. literature research, interviewing, company visit, gather and analyse data, and draw a conclusion or draw up an advice. The lecturer assists the students by giving lectures on certain topics and workshops on certain skills. At the end, students will present their deliverable to the lecturer and the client, if applicable.

The LC is scheduled during a semester with preferably once every two weeks a meeting of 2 hours. Students' time investments depend on their own ambitions.

3. Methodology

This papers presents the results of the implementation of LCs organized during 5 semesters in the academic year, 2016-2017 (s1, s2), 2017-2018 (s3, s4), and 2018-2019 (s5). Of each

LC, several characteristics are analyzed based on the LC's description, such as the educational format (topic-based or project-based), topics offered, skills offered, and link with the professional field (guest lecture, company visit, company project). The skills are categorized in three main areas of 21st century skills according to Trilling and Fadel (2009): learning and innovation skills (e.g., critical thinking, communication, problem solving), digital literacy skills (e.g., media literacy, ICT technology), and career and life skills (e.g., flexibility, cross-cultural interaction, adaptivity, and self-direction).

In addition, the characteristics (gender, nationality, level of education (bachelor or master), discipline) of the participants are analyzed. Herewith we are able to describe if the group of participants within a LC is diverse in gender, nationality, level of education (BSc/MSc), and/or discipline. The LCs were evaluated by the students by filling out a questionnaire consisting of 5-point Likert scale items and open-ended questions on paper during the last meeting of the LC after receiving their certificate. The items dealt among others with students' perception on working with students of different educational levels and different disciplines, and on acquiring different skills, such as employability skills.

Table 1. The topic and number of implemented LCs per semester.

		S1	S2	S3	S4	S5	Total number of participants
1	Mergers & Acquisitions in SME's	x	x		x		43
2	Big Data	x			x		22
3	Programming (Python)	x	x	x	x	x	95
4	Integrated Reporting in SME's			x	x	x	9
5	Strategy: getting real about options		x		x		12
6	Social Impact Analysis of Global Investments	x					5
7	New Business Developments in Africa		x	x	x	x	43
8	Sustainable City Logistics			x	x	x	23
9	Women in Business			x		x	21
10	Working with Agile Project Management Tools				x		14
11	Programming (R)				x		29
12	Economic Policy Research in Practice				x		23
13	Block Chain					x	10
14	Energy Transition					x	5
15	Insights in the International North: Digital Mapping					x	9
16	International Negotiations					x	7
17	Lean Six Sigma					x	17
	Total	4	4	5	10	10	387

4. Implementation of learning communities: practice

4.1. Characteristics of learning communities

In total, 37 LCs were organized, but 33 LCs were executed (Table 1). Eight LCs were held more than once, resulting in 17 unique LCs with a diversity of subjects (Table 1). Three LCs were not held due to lack of applicants. Another LC was a field trip to Silicon Valley,

which was canceled for lack of sponsoring (costs). Especially at the start of the project, the LC was initiated by the lecturer based on his/her own interest and expertise. Later on, several LCs were initiated by the project coordinator and an expert of the field on request by students, such as Lean Six Sigma, Economic Policy Research, and Working with Agile Project Management Tools.

The educational format of the LCs was either topic-based (n = 8) or project-based (n= 8), or both topic- and project-based (n = 1) (Table 2). In almost all LCs, there was contact with the professional field, for instance by company visits, interviews or projects derived from companies. The topic- or project-based LCs were held during one semester and students all worked on one project together. The topic- and project based LC, programming (Python), was held continuously. Students could enter every semester at the level of a novice (learning programming through instruction), a beginner, or an expert (both working on projects). The skills written in the description of the LCs were categorized. Almost all LCs offer learning and innovation skills. Seven LCs offer digital literacy skills and 13 LCs offer career and life skills (Table 2).

4.2. Characteristics of the participating students

All learning communities, except for one, consisted of students of different disciplines. This one LC, the first LC on Big Data, only consisted of MSc Marketing students. This was probably caused by the fact that the lecturer promoted the LC during a regular course of the MSc Marketing degree program. Two other LCs (Social Impact Analysis of Global Investments and Working with Agile Project Man. Tools) also consisted only of MSc students. All LCs consisted of students with different nationalities. Most of the LCs showed gender diversity, except for Women in Business (twice, only female students), M&A in SMEs (S2, only male students), and Integrated Reporting (S3, only male students).

4.3. Students' evaluation

Overall, students strongly agreed that the LCs as a whole was a good learning experience for them (mean score 4.5). Especially, the combination of insight from practice using cases of companies with theory was positively evaluated. The theme kept the students motivated to continue to participate in the LC.

The educational format and the guidance by the lecturers is experienced as helpful and pleasant. One student (LC Big data) stated that '*the good thing is that they didn't helped us too much. This way we were forced to discover our own ways to solve problems*'.

Table 2. The educational format of and the skills offered by the LCs.

| | LCs topics | Educational format, based on | | 21st Century Skills offered | | |
		topic	project	Learning and innovation	Digital Literacy	Career and life
1	Mergers & Acquisitions in SME's	√	-	√	√	√
2	Big Data	-	√	√	√	√
3	Programming (Python)	√	√	√	√	√
4	Integrated Reporting in SME's	√	-	√	-	√
5	Strategy: getting real about options	-	√	√	-	√
6	Social Impact Analysis of Global Investments	-	√	√	-	√
7	New Business Developments in Africa	-	√	√	√	√
8	Sustainable City Logistics	-	√	√	√	√
9	Women in Business	√	-	√	-	√
10	Working with Agile Project Management Tools	√	-	√	-	√
11	Programming (R)	√	-	-	√	-
12	Economic Policy Research in Practice	-	√	√	-	√
13	Block Chain	√	-	√	√	-
14	Energy Transition	-	√	√	-	-
15	Insights in the International North: Digital Mapping	-	√	√	-	√
16	International Negotiations	√	-	√	-	√
17	Lean Six Sigma	√	-	√	-	-

Students enjoyed working with students with a different educational level (mean score 4.2) and background (mean score 4.4). Some remarks students made are: '*I think that different levels add their own ideas and way of thinking to the LC*' (LC M&A in SMEs), '*It is interesting they* [students of different disciplines] *have different ideas on the same business problem*' (LC Strategy), and '*People were sharing their knowledge in their fields during the discussion*' (LC M&A in SME's). Most points of improvement giving by the students concerned the scheduling. They missed the structure they have during regular courses. Especially in the beginning of the LC they want to have more meetings to get a head start.

5. Discussion and Conclusion

The aim of this paper is to evaluate the implementation of extra-curricular, multi-level and multi-disciplinary LCs that are open for all students at the faculty of Economics and Business. The LCs were developed using established guiding principles including the choice of the theme, the educational concept, and the scheduling. The questions we want to answer are which guiding principles actually are implemented in the LCs and how do students evaluate these guiding principles in the LCs.

There was a great variety in themes, which attracted both BSc and MSc students from different degree programs. The themes of the executed LCs were all beyond the regular curricula. The LCs that were offered but did not continue due to lack of students did have a theme that is part of the regular curriculum, namely entrepreneurship, sustainability, and ethics. Hence, students were probably not interested to follow these LCs. Furthermore, most LCs offered career and life skills. If no contact with the professional field was included, students asked for it. So, in the future we need to stress that contact with the professional field and a theme not covered in the regular curriculum is a necessity.

Despite the guiding principle, half of the LCs were project-based. The other LCs were organized on basis of learning a topic or skill, such as Programming (R), Lean Six Sigma, and Block chain. These LCs also did not offer career and life skills. Nevertheless, students appreciate these LCs and were very motivated to learn the knowledge and skills offered. So, in the future this format should be allowed with the requirement that the LC should offer knowledge and skills that strengthen students' professional preparation and increase graduates' employability.

Since the most important points of improvement of the students was to increase the contact hours at the beginning of the LCs, the guiding principle during the 5 semesters changed from meetings every 2 weeks to weekly meetings in the beginning followed by less meetings towards the end of the LC.

In conclusion, we have evaluated the implementation of extra-curricular, multi-disciplinary and multi-level learning communities (LCs). The results lets us conclude that according to the guiding principles, a variety in themes were implemented. In addition, in contrast to the guiding principles also a variety of educational formats and schedules were implemented. However, students' positive experiences make clear this should be allowed in the future. A key issue to reinforce in the future is to emphasize that the career and life skills should be part of each LC and the contact with the professional field is a necessity. In general, these guiding principles can be used to create extra-curricular, multi-disciplinary and multi-level LCs at any higher education institution. Overall, the great commitment of lecturers as well as students led to a successful realization of these multi-disciplinary, extra-curricular and multi-level LCs.

Acknowledgements

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Switching perspectives: Physicians meet Engineers in a Novel Lab on Medical Device Development

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Abstract

Education nowadays often still lacks in seeing the big picture. While becoming an expert in a certain, narrow field is naturally desirable, switching disciplinary perspectives is mandatory for an overall understanding. Next to benefiting from the knowledge of other disciplines itself, the merging of two disciplines and their actors leads to a synergy effect through the exchange of their knowledge and experience. Therefore a mixed course structure consisting of theoretical and practical parts seems most feasible to guarantee varying degrees of didactic approaches including co-operative course designs. In this paper our already well established advanced lab on medical device development (part of the Bachelor's degree in Computer Science) and its enhancement towards an interdisciplinary lab and lecture with medical students is presented. Based on the existing lab, we analyze the prior knowledge of physicians and computer scientists and derive contents, structure and necessary competence goals for a four-week block course. The main objective of the lab is to enable the students of both disciplines to share a common language and a common understanding of the procedures, approaches and tools.

Keywords: Advanced Lab; Digital Medical Devices; Digital Medicine; Interdisciplinarity; Computer Science, Physicians.

1. Introduction

1.1. Motivation

Studying Medicine in Germany is strictly regulated and lacks of interdisciplinary courses, although an exchange with other disciplines would broaden the horizon of the soon to be physicians. The same applies for other fields such as engineering, which could profit from a closer collaboration with the respective users. Since the winter semester 2012/13, the University of Siegen offers a new major in Medical Informatics for the Bachelor's degree. It is tightly connected to the well-established curriculum of computer science and extends on that knowledge by incorporating the very basics of medicine and biology. Of course the students insights to those disciplines are limited because of the restricted amount of ECTS points which can be given on all modules together. One Part of the bachelor's program is a so-called in-depth lab-course which is mandatory for all majors in computer science. As there was no lab-course for the major in Medical Informatics at first, this new lab-course was developed in the summer semester 2014. The new lab enables the students to link their acquired knowledge and skills on computer science to the basics of medicine and biology they learned earlier. The nature of the lab is solely practical with the focus on practical problems from the study focus. The aim of the practical course "Medical Device Development" is to introduce the students of computer science (especially those with the major in medical computer science) to hardware development and to show them that using relatively simple techniques are enough to measure biomedical signals. One possible application in our lab is a self-made ECG to monitor the user's heart activity. As it is in the nature of a lab, the course should consist of a large practical part and foster the students motivation and creativity. Due to the very successful runs in the previous years, we are now opening the lab to physicians to create interdisciplinary working groups. By implementing this we expect to generate a fruitful connection between developers and practitioners which will lead to an increased understanding on both sides.

The remainder of this paper is structured as follows: First, the learning objectives and the motivational factors of our already established advanced lab on medical device development will be described. This is followed by a description of the concept and the implementation of the advanced lab in section two. Here an evaluation of the previous runs is also given. In section three the course modification towards an interdisciplinary lab is outlined. Finally, a conclusion and outlook on future works is given in section four.

1.2. Learning: Objectives and Motivational Factors

Our advanced lab on medical device development has been development in consideration of educational objectives defined by Bloom (1956), Dave (1970) and Anderson (2001) as well as the intrinsic motivation described in Deci and Ryan (1985). Theoretic groundwork has

been considered in form of embedded-system specific competence descriptions, too (e.g. Schaefer et. al., 2012). The overall goal is to address all three domains of educational learning (using the revised taxonomy of Bloom). For this, the lab is divided into three different parts (see sections 2). In the preparation phase, the students should bring up their prior knowledge and different topics regarding overall system architecture such as user interfacing, wireless transmission, sensors etc. have to be worked out. This covers the knowledge skills 'remembering' and 'understanding' in the cognitive domain. The practical phase consists of different exercises, which range from 'applying' to 'creating' in the cognitive domain. This is complemented with the advanced lab's follow-up and feedback phase, which emphasizes the knowledge 'analyzing' and 'evaluating'.

In the preparation phase the students are already separated into smaller groups of two to three students. In the affective domain this fosters the attitudes 'receiving' and 'responding', since as early as in the end of phase one a first group presentation has to be given by each group and discussed with the other students. In the course of the lab, especially in the practical phase, this is carried forward and supplemented with 'valuing' (Anderson, 2001).

The different skills of the psychomotor domain are developed and trained in the advanced lab's practical phase. While in the first exercises basic skills up to 'guided response' and 'mechanism' are touched upon, the last exercise addresses the student's creativity. Skills acquired so far should lead into self-invented projects, that covers the complex behaviors 'adaptation' and 'origination' (Dave, 1970).

Next to considering the three domains of educational training, it is also important to satisfy three innate needs in order to lay the foundation of optimal learning conditions: competence, relatedness and autonomy (Deci and Ryan, 1985). In our advanced lab, basic exercises at the beginning of the practical phase ensure a sense of achievement and therefore competence. The learning setting including working in small groups and the presentation of results guarantee relatedness and the practical phase's last exercise (self-invented project) allows autonomy.

More details on the concept and implementation of our advanced lab is given in the following section.

2. Advanced Lab Project

2.1. Concept and Implementation

Each Credit Point in Bachelor and Master studies corresponds to a workload of approximately 30 hours. This module of 5 CP therefore entails a workload of 150 hours (consisting of the lab and self-study). The total time is divided into the following three phases (see Table 1):

Table 1. Comparison of the advanced lab's phases corresponding to the workload

Phase	Duration in weeks	Duration in hours
Preparation Phase	1	35
Practical Phase	2	80
Follow-up and Feedback Phase	1	35
TOTAL	4	150

Preparation Phase: In order to provide students with an understanding of the course conditions, structures and procedures, an introductory event is organized before the practical phase. At first the reference to medicine and computer science is created. Afterwards the tutors present the hardware components which will be used. The course is divided into smaller groups of two to three students that also work together in the practical phase. Such an approach also makes sense because engineering work is usually carried out on a cooperative basis. The mind-map method is used to give all students a simple way to make the inherent comprehension of the devices internal mechanisms and their communication visible. The different groups present their results in a short presentation to the other students. Finally, a summary of all results is given on the whiteboard. In the remaining preparation phase, different topics are assigned to the groups to acquire a deeper knowledge and become an "expert" in their fields. At the beginning of the practical phase, the students should present their gained knowledge to the other groups in a short presentation.

Practical Phase: In the practical phase, the students first start to explore working with microcontrollers. This is achieved via four exercises. In order to prepare the students for the advanced lab, the basic knowledge of a simple microcontroller circuit, consisting of sensors and actuators, is imparted in the first exercise. Basic knowledge of diodes, various sensors, the microcontroller and C-programming must be acquired before the first meaningful source code can be tried out. The second exercise adds an LCD display to the entire system to visualize the read-out sensor values, and a Bluetooth module to transfer the data for visualization to a mobile device (see Figure 1. ECG-Hardware of the advanced lab and data visualization on a smart phone). In the next exercise basic knowledge of Java and Android programming is refreshed. The visualization of the sensor values is first done with the help of a text output. The sensor values have to be shown on the display with the help of a coordinate system/graph afterwards.

A special attention has to be paid to the fourth exercise. A conception and realization of a small project has to be carried out. The open task should promote the acquired skills and apply them to a self-invented project. This challenges the students to rethink their

understanding of the previous lab exercises and apply all gained competences to deepen the examination of the subject matter.
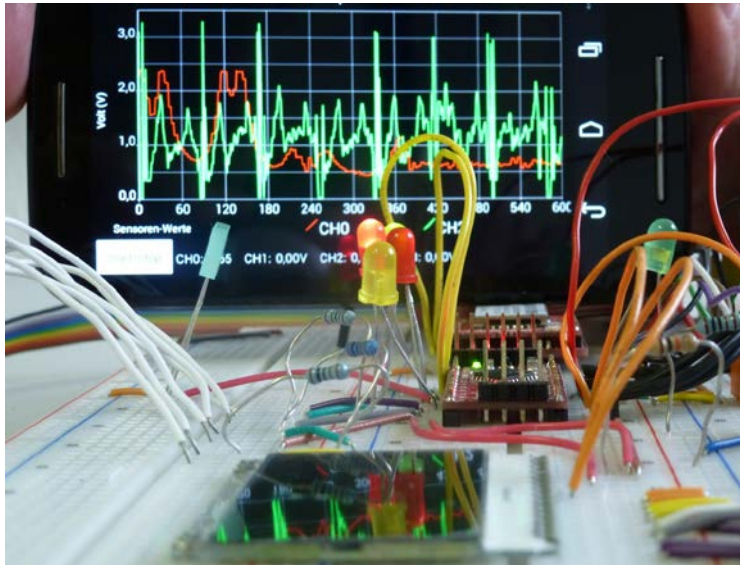
Figure 1. ECG-Hardware of the advanced lab and data visualization on a smart phone

Follow-up and Feedback Phase: At the end of the advanced lab, students have to write a coherent text of 5-10 pages to summarize and evaluate their work. In order to help the students in structuring, questions have been worked out in detail beforehand. In addition, the students should give the tutors a general feedback on the advanced lab. An open and appreciative feedback can achieve a significant effect, because it enables the chance for further development and change of the lab course.

2.2. Evaluation

In general, the lab was rated as very educational by 25 students. They quickly have had their first positive experiences even without large prior knowledge, which has increased their motivation. The order in which the exercises were arranged have been rated useful, because the requirements were increasing and the exercises were based on one another. The group size of two to three persons has gained positive feedback as well as the daily working hours in the laboratory. Furthermore, the third exercise has been evaluated as too long and more support should be given in form of predefined parts. Especially the fourth exercise was evaluated highly positive. The range of different components for the open task was welcomed and used by some groups in exciting projects. However, more time was required for processing this exercise, which can be achieved by optimizing and shorting the third exercise.

The relationship between electrical engineering, computer science, and medicine has been evaluated as unequal, because less medical knowledge has been needed, in order to work on the experiments successfully. More medical aspects, sensors and topics could be added in the practical course.

3. Interdisciplinary course modification

As we read the reviews of our students on the traditional lab, we realized that we could strive for an even more practical approach by not only allowing computer science students but students of medicine to participate on the practical course, too. The benefits of incorporating developers with users into a lab are shown in Table 2.

Table 2. Benefits of interdisciplinary work

Medical students	Computer-Science students	Together
– Knowing the limits and possibilities of hardware/ software products – Understanding the complexity of hardware/software interactions – Experiencing common mistakes and their possible disastrous outcomes	– Given feedback on the practicability of their designs and solutions in terms of applicability in real life scenarios – Better understanding of the modes of action on biological processes as the basic foundation of sensor development	– Working on a common language to address tasks and challenges – Understanding different perspectives (medical and technical) on the same product

As appealing as these opportunities for a common understanding of two very complex disciplines are one has to make sure that all students share at least a basic knowledge of medicine and electrical engineering. The latter is not a problem in our situation because our computer science curriculum fosters various competences ranging from programming skills and hardware design to electrical engineering and even fundamentals of anatomy. More problematic on the other hand is the basic education of medical students in regards of computer science and digitalization skills - commonly missing in German physician curricula. We designed an introductory course which fits nicely in our flexible lab structure described earlier in order to meet this problem (see figure 2). The course conveys theoretical knowledge in the morning and the according practical skills in the afternoon. We have chosen this approach in order to make the transfer of theoretical and practical knowledge as easy as possible for the students.

Week 1	Week 2 to Week 4
Introduction to Medical Informatics	**Creative seminar - digitalization in medicine**
Morning • History of medical IT • System classifications • Electronic records (EPR/EHR) • Hospital Information Systems • Medical Imaging algorithms • Biomedical Sensor-Based Systems	• Research and summarizing elaboration on available solutions, scientific approaches and future perspectives for digitization concepts in the field of medical and medical-related fields of application (e.g. care, rehabilitation, prevention). • Goal: Lecture presentation of 30 minutes + 15 minutes discussion per small group
Introduction course. Lab fundamentals	**Advanced lab project. Technical Skills**
Afternoon • Soldering and programming • Basics of sensor circuits • Soldering of a predefined PCB-Layout • Basic programmingskills in Arduino (C/C++) • Development of a Heart-Rate monitor	• Biomedical signal processing (ECG, EMG, GSR, ...) • Visualization using a Smartphone (Android development) • Sensor circuits on a breadboard • Programming of a microcontroller • Wireless interfacing via bluetooth • Visualization of biomedical sensor data on a mobile device

Figure 2. Preliminary course modification for the interdisciplinary lab

The course takes place in this structure for four weeks as a block event and incorporates a creative seminar as well as an advanced lab project after the fundamentals of theory and practice have been thought in week one. The lecture "Introduction to Medical Informatics" builds up the theoretical foundation of digitization in medicine and the history and milestones of computer science as the major discipline to foster this process. The students have their first practical introduction to soldering, basic of electronics, and sensor-circuits in the afternoons of week one. This part of our course uses the didactic concept of deconstruction which fosters competencies by giving the students an already build and finished solution (a sensor circuit in our case) first and lets them then deconstruct the whole product into its major building blocks (Magenheim, 2001). This methodology gives students a functional aim to strive for when they build up the system from the ground, as well as constantly raising questions about the need for the several system parts and the constrains which have to be met to incorporate them into the finished device they already saw at the beginning of the lab. We chose to use a rather easy entry to programming languages and corresponding development environments by using the Arduino toolkit which is widely known for its easy entry to the world of micro-controller and embedded device programming.

This interdisciplinary lab seems to be the one which benefits the most from heterogeneous groups consisting of computer scientists and physicians as well. While the latter are up to

tasks like functional and non-functional constraint definitions, sensor selection and overall evaluation, computer scientists have to meet those requirements by choosing a suitable system-architecture and implementing the needed interfaces. However, medicine and computer science students alike should be able to discuss and comment on the ideas and drafts of each other. In the author's opinion, the most important competence to be fostered in the lab is to share a common language and a common understanding of the procedures, approaches and tools between medicine and computer science.

4. Conclusion & Future work

In this paper an advanced lab on medical device development and its modification towards an interdisciplinary lab has been presented. The highly positive feedback on our advanced lab brought us to the idea to open the course to physicians. In order to obtain the best benefits from this, a four-week mixed course structure consisting of theoretical and practical parts has been developed. Special attention has been paid on dealing with the heterogeneous prior knowledge of the students and to foster the communication and exchange between the two disciplines medicine and computer science. The evaluation of the interdisciplinary lab will be performed in near future. Using our approach as a blueprint, an extension towards other disciplines than medicine will also be pursued.

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Networks that Cross the Boundaries of the Classroom: A Quasi-Experimental Study of University Students

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Abstract

Currently there is a trend towards facilitating multidisciplinary research and collaborations between different faculties and/or multi-university collaboration. In order to achieve standardization, we believe that this culture should begin with the teaching-learning processes. This research has investigated collaborative work between nursing students and computer engineering students. To analyze the group response, an analysis of the contacts was carried out through Social Network Analisys, pre- and post-intervention. The student networks analyzed were friendship, collaboration and negative networks. The results show that the intervention had a positive impact on networks among students, creating greater cohesiveness due to the resources they shared. The research adds useful evidence for proposing innovative and multidisciplinary strategies in terms of networks.

Keywords: Social Networks; collaboration; intervention; university students; innovation learning

1. Introduction

The use of technology can be useful in the teaching-learning process for nursing students. Different studies have shown that developing technological competencies could help the student to increase their interconnectivity in order to receive support in academic tasks and even in social and personal areas (Todhunter, 2015). Currently, there is a trend to create academic structures that promote nursing in global health. For this purpose, some initiatives have been developed in the USA to facilitate multidisciplinary research and collaborations between different faculties and / or multi-university collaborations (Gimbel et al, 2017). Thus, we consider that technology and anything linked to computer engineering could add value to health care, given that it is usual for nurses to know patients' needs but not how to propose technological solutions, whereas computer engineers can quickly find such solutions. For this reason, a multidisciplinary teaching experience is proposed, in cooperation with nursing and engineering students.

There are previous experiences based on education and contacts, such as the case of peer education, which establishes cooperation and counseling between two students, both within the same and different courses, in which older students teach and advise younger ones (Farrokhi et al, 2018). But there is a lack of studies that delve into the analysis of how those relationships between two people build larger networks through which knowledge, confidences, concerns, motivations, etc. are shared, and which could be organized in order to achieve good academic performance and well-being within the university community. Resources that are transferred through the contacts, and their optimization, can be analyzed through Social Network Analysis (SNA).

SNA is an analytical method which studies the relationship between different social entities and the repercussion of those links (Wasserman et al., 1994). Its main elements are nodes and relationships. In SNA the concept of *actor* does not only refer to how a node acts, but it also emphasizes how the node is examined in terms of relational behavior within the social network (Lozares, 1996). On this basis, nodes can be connected through relationships and, therefore, their objectives and goals can also be connected (Robins, 2015). This perspective is extremely useful when approaching educational strategies in the university context, since we would be abel to explore what kind of positions or structures would allow for better academic performance and, in general, a very satisfactory university life experience. The importance of connectivity is added to the importance of structure. Connectivity is a process of interpersonal transmission between those who have or have had social ties (Borgatti and Foster, 2003). Thus, resources, such as friendship, help, and even negative relationships can be transferred.

There is ample literature in the educational field on the application of SNA. Topics such as the 'adverse effects of students' stuttering on their social and emotional functioning at school'

(Adriaensens et al, 2017), 'class collaborations to create multimedia stories' (Liu et al 2017), and 'case evaluations of clinical studies by doctors' (Saqr, et al, 2018), among others, have been addressed.

Therefore, the general objective of this study is to assess the impact that a teaching-learning intervention can have on the networks of nursing and engineering students at university. At a general level, this study aims to compare network behavior before and after cooperative work is carried out between both groups of students. Cooperative work is influenced by structural mechanisms of networks (Jostad et al, 2013), which in turn, influences the dynamics of the network. Thus, we are assuming that a network is not static, and that its dynamics can also be channeled and optimized to achieve the best results in students.

In summary, with this research we intend to answer the following question: *Can intervention in the teaching-learning process change the network of relationships among students?*

2. Methods

2.1. Context

The study was carried out at the University of León, Spain. The University of León promotes educational innovation processes by means of annual calls. This research project was presented for one such call and selected as a proposal for educational innovation. The professors who led this educational-innovation project taught two subjects: Nursing Management (Nursing Degree) and Semantic Web (Computer Engineering). Student groups consisted of 3-4 nursing students and 3-4 computer engineering students. The nursing and engineering students were on different campuses separated by 100 km, so their usual contact was through telephone calls, online chats, etc. In each group, the nursing students were supposed to work on a need arising from the patients, and the engineering students to present a technological proposal. Based on this, the following plan was established:

Stage 1. Evaluate networks between nursing and engineering students on the first day of work. On the first day of work, students and professors had a face-to-face session at the Ponferrada Campus so that the students could introduce themselves to each other, as well as be presented with the methodology and objectives of the work. They were also given information on when they would have to finish the work, how they would give their presentation and what the evaluation criteria would be. Regarding the presentation, the process was to be as follows: Nursing students would present the work of the engineering students, and vice versa. This decision was made by the professors because among competencies to be evaluated was "*communication*", which implied a facility to communicate with the rest of society, i.e., not exclusively with people from their professional environment. For this reason, engineering students, for example, would have to explain their contents to

nursing students in such a way that the latter would understand them and subsequently be ablel to present them, and vice versa.

Stage 2. For 40 days students worked on each part of the assignment in their respective subjects, keeping contacts with fellow students via online chats, phone calls, emails, etc. During this phase they were continually supervised by the professors. Nursing and engineering professors also had contact with each other in order to assess the whole process and remain coordinated.

Stage 3. On the last day, the students presented their work via videoconference, from their respective campuses, namely the Ponferrada Campus (Nursing students) and the Vegazana Campus (Engineering students). On that day the professors evaluated each presentation using a rubric containing criteria related to content, structure and clarity of the presentation, communication skills, innovation and the impact of the proposal.

2.2. Subjects

Participating were 50 students, 26 3rd year nursing students and 24 4th year computer engineering students. Two professors collaborated in each subject area. The students were divided into 9 workgroups. They had to address issues related to cybersecurity and health monitoring, loneliness and artificial intelligence, and nurse-bloggers who cater to young people with problems related to addictions or obesity.

2.3. Study design

This is a quasi-experimental descriptive study with pre and post-intervention. On the first day of class the subjects were monitored in real time using SNA. On the last day of class, they were monitored again to assess the dynamics of the networks.

2.4. Data collection

To collect the data anonymously, a custom multiplatform application was programmed making use of web technologies (PHP, HTML5, CSS, Javascript) and a MySQL database system. The web application was hosted on a server which allowed students to connect to it through a URL, and through a user-authentication system students were able to answer different questionnaires, some of them having the objective of collecting engagement and socio-demographic data from the students (Benítez et al., 2017). The data was oraginzed with Excel. UCINET was used to calculate the structural variables.

2.5. Data analysis

The networks in which structural patterns were analyzed were:

Friendship Network. Which of the following fellow students do you consider as a friend?

Collaboration Network. Which of the following fellow students do you ask for help when a problem / doubt / difficulty in the academic field arises?

Negative Network. Which of the following fellow students do you AVOID interacting with?

2.6. Research ethics

The students were informed verbally of the study-objectives and signed an informed consent form. Confidentiality of data and anonymity of the subjects were maintained at all times. The study was approved by the University Ethics Committee (ETICA-ULE- -026-2018).

3. Results and discussion

The findings show that the networks are dynamic and do not correspond to a static image (Figures 1, 2 and 3). In particular, our networks are less densely connected among students before starting a cooperative activity than they are at the end of it. But this is not only true among students of different degrees (nursing, engineering), which would be logical, but also among students of the same degree. This result is in line with previous studies that have shown that people's attachment style can be altered by dyadic influence, so that individuals manage their social networks (Gillat et al, 2017).

The question is what kind of attention should be given to these dyadic relationships, and to the resources that are transferred, such as friendship, help, negative relationships, etc. This discussion is interesting because the results could be influenced by the structure and dynamics of the networks. Indeed, the most popular students create norms in the classroom, and can influence the processes of friendship that are created around achievements and objectives to be reached (Laninga-Wijen et al, 2018). In this sense, it has also been found that the matching of students and the formation of larger networks has a positive impact on their engagement, and this, in turn, on academic performance (Liu et al, 2017, Fernández-Martínez et al, 2017). Even negative or toxic relationships could have some positive impact, depending on whether the negative ties are direct or indirect, and how they are combined with other networks (Marineau et al, 2016).

Figure 1. Frienship Network Pre-intervention and post-intervention
Blue circle node: Male engineering student; Bordeaux circle node: Female engineering student
Blue square node: Male nursing student; Bordeaux square node: Female nursing student

Figure 2. Collaboration Network pre-intervention and post-intervention
Yellow circle node: Male engineering student; Green circle node: Female engineering student
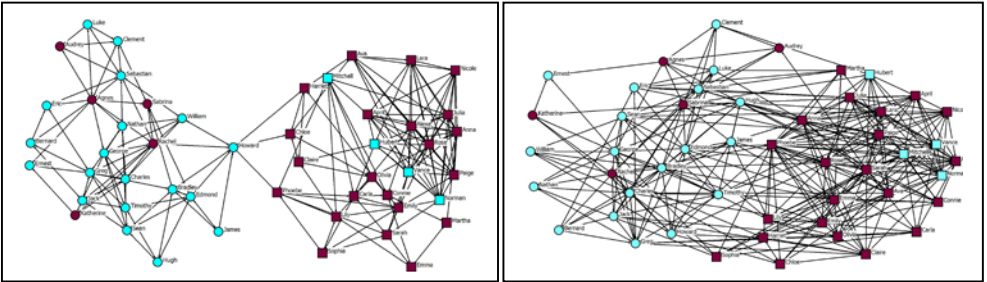*Yellow square node: Male nursing student; Green square node: Female nursing student*

Figure 3. Negative Network pre-intervention and post-intervention
Green circle node: Male engineering student; Mallouc circle node: Female engineering student
Green square node: Male nursing student; Mallouc square node: Female nursing student
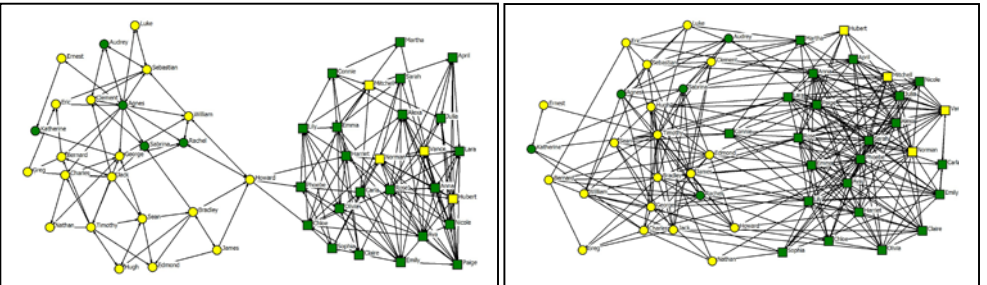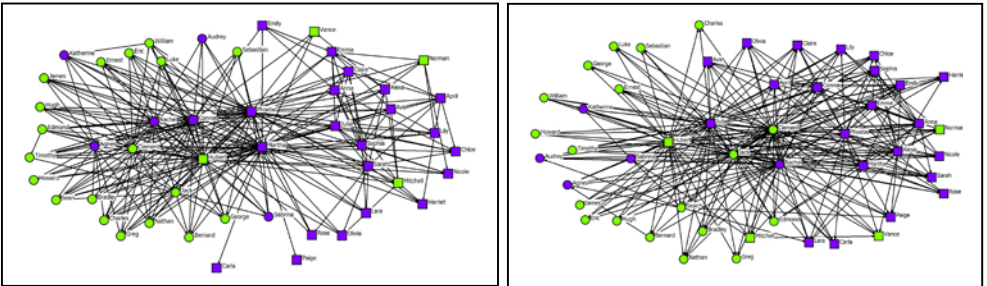
4. Conclusion and limitations

Our findings add evidence to the small core of studies that addresses positive and negative networks in the academic field. SNA can be used to design the most appropriate strategies in teaching-learning processes both within and outside the classroom. The ties and relationships cross the boundaries of the classroom. Students form cliques that could have an influence on the academic climate (Kamiri et al, 2018). On the other hand, these experiences also have a very positive impact among professors. In our case, the professors started a relationship that has been cemented, leading to collaboration in the same research group, the SALBIS group (www.salbis.es). This type of collaboration achieves great added value, because the heterogeneous relationship that professors model set a standard for their own students, so that they normalize interdisciplinary collaboration.

An important limitation to this study is that it does not include other structural variables, which will be taken into consideration in future lines of research.

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Thinking about going to university? Segmenting undergraduates

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Abstract

Choosing a university is a crucial decision in a person's life because, most of the time, the acquisition of a university degree allows him access to better working conditions. Universities are interested in knowing the factors that students cite as impacting their choice of university. This study aims to classify future university students according to different evaluation criteria that could help university administrators to improve their recruitment and positioning strategies. Building on the growing body of knowledge related to the marketing of Higher Education Institutions, the current study seeks to further explore the existence of segments featuring different selection patterns. The main goal of this study was tested by applying Latent Class Analysis as a segmentation method, also referred to as Latent Class Cluster Analysis. This study found that students have different sets of motivations for their choice of Higher Education Institutions, and also found significant differences in the motivations of males and females with regard to university selection. All of these findings are of great importance to the managers of university brands, particularly at the university under study.

Keywords: undergraduate university selection process; student choice; recruitment.

1. Introduction

The attention of Higher Education Institutions (HEIs) is currently focused on two main objectives: attracting new students and retaining current ones (Rowley, 2003), as universities compete with each other in the educational market for resources, prestige and students.

As the decision pattern becomes more complex and competitive, it is imperative that HEIs continually review the factors that have an impact on their choices, applying the results of this research to optimise their design of students retention and acquisition strategies.

Decisions are normally based on a combination of available information, the recommendations of third parties, perceptions of the image of the university, and the reputation of the institution (Briggs and Wilson, 2007). The way applicants access the information is usually through brochures (Connor *et al.*, 2001), visits to universities, consultations with the staff in charge of the institution (Moogan and Baron, 2003). In some studies it has been detected that access to information often depends on social class (Christie *et al.*, 2001). In addition, parents' perceptions of higher education institutions (HEIs) can have a significant impact on their children's choices (Parker *et al.*, 2007).

Market segmentation is an important topic for higher education managers and researchers (Angulo-Ruiz *et al*., 2010). However, despite its administrative relevance, there has been little attention to segmentation in the higher education market. In order to segment it, market researchers have to consider which factors are most relevant to high school students when selecting a university. Previous studies have demonstrated the importance of rational factors, such as academic programs, economic criteria, and teaching staff. Less attention has been paid to other motivations and emotional criteria, like independence from parents, leisure facilities, and the quality of life on the university's campus and/or in its city.

This study aims to classify future university students according to different evaluation criteria that could help university administrators to improve their recruitment and positioning strategies. Building on the growing body of knowledge on the marketing of Higher Education Institutions, the current study seeks to further explore the existence of segments presenting different selection patterns.

2. Theorical background

A review of the main studies on the selection criteria of future HEI students is presented in Table 1.

Table 1. Main authors and contributions on the selection criteria of future HEI students.

AUTHOR(S)	MAIN CONTRIBUTION
Connor *et al.* (2001)	Survey of future students in Scotland. These authors found that the suitability of the subjects taught at the university was the most influential factor. Other factors included job prospects, the reputation of the teaching, the university's image, acceptance requirements, academic support facilities, and location.
Soutar and Turner (2002)	The author analysed the importance of a number of attributes to graduating high school students in Australia. The results indicate that the four most important factors determining university preference were: course suitability, academic reputation, job prospects, and teaching quality.
Moogan and Baron (2003)	Survey at six universities in Great Britain. The results demonstrated that during the evaluation of alternatives phase, course content was more important to females, whereas reputation was more important to males. The most critical factor in causing apprehension was that of grade expectations, with females being less confident than males about having the necessary entry qualifications.
Pimpa (2005)	This study examines the influence of family on students from Thailand. It proves that financial influence is the strongest family influencing factors and family expectations is the second.
Briggs (2006)	This article explores the factors influencing student choice at six contrasting Scottish universities. Results illustrate consistency in respect to the top three factors: academic reputation, distance from home and location.
Hagel and Shaw (2008)	Survey of future students at an Australian university. The findings from the study indicate that the most important reasons were: study mode, tuition and university reputation.
Joseph *et al.* (2012)	Exploratory study using survey data at two universities in the United States. The importance of university selection criteria differs between those who attend public and private institutions. • Private university students appear to value reputation, selectivity, personal interaction, facilities and cost; whereas public university students value programmes, athletics, reputation, cost, housing and location. • "Reputation" for students at public institutions was limited to perceptions of quality education and accreditation, while students at private institutions saw reputation as including name recognition and the renown of the university/department.
Chen and Zerquera (2018)	This study utilized data obtained from 7,688 students residing in the tri-country metropolitan area in USA. They conclude that students with higher academic achievement ar more likely to enrol at colleges further from home, perhaps because they recruited by more selective institutions. Family socioeconomic status plays a significant role in college access and choice.
Haywood and Scullion (2018)	Focused on parents, an under-researched group. The results indicated that they experience this process primarily as parents, not consumers, and that their desire to maintain their relationships at this critical juncture is more important to them than the choice of particular academic programmes and universities.

Choices by students do not follow a simple linear or rational process. Rather, the selection of a university involves a complex process affected by numerous factors, such as cost, information available, the way to access the university, academic achievements, and campus life and experiences (Foskett and Hemsley-Brown, 2001; Moogan and Baron, 2003). There is a consensus at the international level that students' choices depend on multiple factors (Connor *et al.,* 2001, Kinzie *et al.,* 2004) and a growing recognition of the need to understand the most decisive factors in the selection of a university (Connor *et al.,* 2001).

However, there are few studies that have researched how students really analyse and weigh these attributes. A widely used method to examine alternatives in decision-making is joint analysis, which allows preferences to be broken down into their constituent parts (Hagel and Shaw, 2008). Three published studies have reported findings with respect to the selection of universities using this method (Hooley and Lynch, 1981, Soutar and Turner, 2002, Moogan and Baron, 2003). The results of the three studies on the relative importance of the degree/curriculum offered, academic reputation, and location, were consistent with the existing literature, although none of these studies included academic fees and costs in their criteria. In addition, it is assumed that students conceive of their choices as based on sets of characteristics, and prefer these specific ones over the products as a whole (Hagel and Shaw, 2008).

However, it is worthwhile to consider whether this set of characteristics is exhaustive and still valid. Recent studies, such as that by Kinzie *et al.* (2004), have found that the factors that impacted choices in the 1990s are similar to those identified in surveys from the 1960s, in which importance was attached to the curriculum; the usefulness, or employability, of the education; recommendations by third parties, and the social side of university life.

Taking into account this background, it is necessary to make a continuous market research effort in order to understand students' choice criteria.

3. Method

3.1. Data collection and Instrument

A personal survey was used with fixed-alternative questions measured on a 10-point Likert scale. 605 questionnaires were considered before removing the incomplete or incorrectly completed ones. With regard to the total group of students surveyed, 44.3% were men and 55.7% were women. The questionnaire includes 9 criteria obtained from previous studies, such as that by Joseph *et al.* (2005), and two focus group with university administrators in charge of student recruitment and communication campaigns.

4. Results

4.1. Model fit

The main goal of this study was tested by applying Latent Class Analysis as a segmentation method, also referred to as Latent Class Cluster Analysis (LCCA) because of its significant advantages over other segmentation procedures. The parameter estimation model was carried out using Latent Gold® 4.5. The results indicated that there were five groups of student groups, according to the BIC and CAIC criteria.

4.2. Parameters

Once the number of clusters had been established (five), the significance of the indicators and covariates was evaluated. On the one hand, the p-value associated with the robust Wald statistic was less than 05 for all the indicators, indicating that these were a significant contribution toward discriminating between the five clusters considered.

4.3. Clusters' profile

The main characteristics of the clusters of students are the following (see Table 2):

Table 2. Means and characteristics for clusters.

CLUSTER (SIZE)	C.1 (38.2%)	C.2 (31.9%)	C.3 (11.2%)	C.4 (9.7%)	C.5 (9.1%)	TOTAL
High school teachers' advice	3.0	3.9	3.0	1.8	4.1	3.2
Economic aspects (family income)	4.6	5.7	5.2	4.8	5.5	5.1
Grades for admission	7.2	7.8	5.5	7.0	7.6	7.2
Social activities/City night life	5.1	7.1	3.5	6.8	9.0	6.1
Becoming independent from parents	6.5	8.0	2.0	9.9	9.9	7.1
City's quality of life	6.9	8.4	4.4	9.8	9.9	7.6
Accommodation cost (rentals)	6.9	8.2	3.4	8.7	9.8	7.4
Study abroad programmes	5.2	8.1	5.3	5.4	8.5	6.4
Internships/practicum programs	6.3	8.5	6.2	5.5	9.5	7.2

Cluster 1. HIGH ACADEMIC PERFORMANCE. This group is primarily made up of men, at 52.4%. Grades are an important reason for them (value of the affirmation equal to the average). However, it is the group that assigns least importance to economic aspects.

They seek access to degree programmes related to Science and Technology (Engineering and Science), which require high grades for acceptance.

Cluster 2. HIGH ACADEMIC PERFORMANCE BUT ECONOMY AND WOM. This group is made up primarily of women (59.5%). They assign the highest priority, of all the groups, to economic factors and the grades required for acceptance to the university. They also stand out because they taken into account, more than the average across the sample, the recommendations of teachers at their high schools.

Cluster 3. UNCONCERNED. This group presents scores below the average in almost all criteria. They only assign more importance to economic criteria. This group is made up primarily of women (52.6%).

Cluster 4. BEING INDEPENDENT OF PARENTS. This group, women in their majority (67.7%), values, above the average, and with very high scores, living away from home and independent of their parents. They also take into account the quality of life in the city chosen. This group also stands out for being the least influenced by the recommendations of teaching staff, and that which attaches the least importance to economic aspects, together with Cluster 1.

Cluster 5. OVERINFORMED. They value all the criteria above the average in comparison with the rest of the groups. They take into account all the selection factors when making their decision and, therefore, a much more complex process to choose their universities and study programmes is to be expected. As a characteristic setting them apart, they are the group that most values the opportunity to study abroad, and internships at companies, when making their decision. They are mostly women (67.3%).

5. Conclusions

This study found that students have different sets of motivation for their choice of HEIs. At the practical level of universities' marketing and recruitment strategies, the considerable differences found can explain why some communication campaigns and information media failed, whereas others have not yet convincingly demonstrated that they are successful and/or sustainable (Becker, 2009; Wilkins *et al.,* 2011). Therefore, the appeal of a university's brand depends greatly on the ability to focus on consumers' specific needs and desires, which is why defining the target for each college helps to bolster the effectiveness of recruitment and brand strategies. The same conclusions were drawn by previous studies, like that by Bock *et al.* (2014).

Our study also found significant differences in the motivations of males and females. Males are more concerned with academic performance, while females consider a great variety of choice criteria. These findings are consistent with those of previous studies (Shanka *et al.,*

2005; Maringe, 2006). When choice criteria are combined with a consideration of these gender differences, it is possible to identify distinct and different segments requiring different marketing and recruitment approaches by universities (Hemsley-Brown, 2017). This approach can be a more effective way to extend the traditional segments and increase student satisfaction, especially with some degree programmes that are mostly oriented towards men or women, such as Engineering, and Nursing, respectively.

Additionally, the size of the different segments identified also has important practical implications for the university under study. Thus, given that the first two segments account for almost 70% of the sample, it seems evident that the university analysed should focus its communication efforts on three aspects. Firstly, it should make an effort to encourage high school teaching staff to recommend the university. Second, taking into account the great importance of academic performance to both Cluster 1 and 2, instruments could be devised –such as search engines, comparison tools etc.– clarifying the number of spots available and the latest grades required for the different degree programmes offered. Thirdly, studies should clearly communicate the advantages in terms of cost (tuition, accommodations, transportation, residence, etc.) of the university studied with respect to its competition.

Starting from the possibility of extrapolating the results to other universities, the UCLM would be a public institution not comparable in its management with private ones or universities outside the Spanish university context. Although this study has been conducted in the context of a Spanish university, it nonetheless has relevance and contributes to the marketing managers across all universities.

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International undergraduate business students' perceptions of employability

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Abstract

Graduate employability is a highly contested topic by education providers, employers and governments. The responsibility of universities to enhance students' employability through work-integrated learning (WIL) opportunities is also debated.

This study explored international students' understanding of employability skills and their self-perceptions of their employability at an Australian university. It also investiaged students' perception of the universities' role in enhancing employability. A qualitative approach informed by Social Cognitive Career Theory (Lent, Brown & Hackett, 1994), used multiple focus groups comprising 18 international undergraduate students from Brazil, China, Colombia, India, Papua New Guinea, South Korea in their final semester at an urban Australian university.

The key findings are: (1) Participants were unable to differentiate between employability skills, personality traits and job-specific skills; (2) The importance of social skills and networking were recognised by Chinese respondents, in particular; (3) The perceived level of work-readiness was higher among respondents who had previous work experience; (4) The inclusion of more practical WIL components in the degree program calls for curriculum review; (5) Creating opportunities for students to apply their knowledge and skills in professional contexts is highly desirable. The findings highlight curriculum considerations needed in the development of high-quality WIL experiences that will enable students to apply the knowledge and skills learnt in the classroom, thus enhancing their self-efficacy about their employability.

Keywords: employability skills, work-readiness, international students, Social Cognitive Career Theory.

1. Introduction

Influenced by the forces of globalisation, the higher education sector has undergone rapid changes over the last two decades. During this time, employers have expressed concerns that graduates lack transferable skills (Industry in Education, 2001; Paisey & Paisey, 2010), and universities have responded by seeking ways to improve graduates' skills. Work Integrated Learning (WIL) opportunities and government initiatives aimed at enhancing job-specific and personal transferable skills are seen as important strategies. WIL is a form of learning whereby study is alternated with industry work placements; this provides students with opportunities to integrate the theories they learn with the practices of the workplace (Bowen & Drysdale, 2017; Eames & Cates, 2011; Nica & Popescu, 2010).

The study aims to explore international students' perceptions of employability, their understanding of employability skills, and the perceived roles of universities in preparing students for employment. Employability is defined by Nilsson (2010, p. 547) as the ability to "successfully manage a job" and "control one's individual career path, thus creating opportunities for mobility and self-efficacy". As individuals are developing their employability skills, they are preparing for working life (Nilsson, 2010). By the term employability skills, this study refers to the skills demanded by employers for successful employment, notably: communication skills, teamwork skills, problem solving skills, planning and organising skills, self- management skills and digital literacy, ability to work with protocols, decision making skills, creative thinking, being flexible, and the ability to work with diverse points of views (Archer & Davison, 2008; Department of Education and Training, 2009; Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education and Department of Education, Employment and Workplace Relations, 2013; Shah & Nair, 2011).

2. Background

Through the process of internationalisation, careers are becoming boundaryless (Arthur & Rousseau, 1996). Hartwig et al., (2017) identify the components of internationalisation of higher education as: enrolment of international students, development of international campuses, exchange programs for students and staff, internationalisation of the curriculum, global research projects and global competition for talent. Another powerful force is multiculturalism, a postmodern construct that promotes cultural diversity and social equality within and across nations (Foster, 2013).

The Australian Government Department of Education and Training (2016) set out a plan to develop the country's role in education while responding to global trends. The 'National Strategy for International Education 2025' is built on three pillars aiming to: (i) strengthen education, student experience and quality assurance; (ii) to establish transformative

partnerships within and outside of the country; and (iii) to compete globally to grow international education. This report places emphasis on work-integrated opportunities on top of the acquisition of industry-specific skills as employability is a key driver for students undertaking a degree course. The pressure on institutions providing business education to provide work-ready graduates is increasing. Universities are introducing WIL opportunities into the curriculum to enhance graduate employability while engaging students in a range of activities that integrate learning and practice (Bennett & Ferns, 2017).

This study gave voice to the students and explored their perceptions about employability. In doing so, the Social Cognitive Career Theory (SCCT) was applied as the theoretical framework. SCCT (Lent et al., 1994) is based on Bandura's (1977) social cognitive theory, which has long captured the interest of researchers in the area of education and career development. SCCT was developed with the aim of summarising and organising existing career-related findings on self-efficacy, while incorporating other social cognitive concepts. SCCT aimed to explain the factors that shape educational and vocational interests.

3. Methods

This study used qualitative methods - specifically, focus group interviews. The research approach followed Marton's (1975) phenomenographic research that aims to identify ways in which different people experience, perceive, and understand a phenomenon.

3.1. Participants

Participants were in their final year level undertaking their Bachelor of Business degree at an urban Australian university. Data were collected in two study periods with the participation of 18 students in total. These students were studying in majors of accounting, international business, management and tourism and hospitality. The country of origin of participants were: one student from Brazil, eight from China, one from Colombia, five from India, two from Papua New Guinea, and one from South Korea.

4. Findings

4.1. Understanding employability skills

Participants' understanding of employability skills were varied. These are summarised in Table 1. The responses are mostly concerned with employers' expectations or applicants' skills, experience, ability and personality.

Table 1. Interpretation of employability skills

Participants' definition
Business/employer/managers' expectation or skills they want from employees
Skills you pre-achieved
Experience relevant to the job/real workplace
Ability and skills to put into work
Ability that can help you to get a job
Replace someone who's already working
How the skills are used
Personality

4.2. Ranking employability skills

The three most important employability skills mentioned by participants were communication skills, team work skills and problem solving skills – regarding the domain of their desired career. The confusion about the difference between employability skills, job-specific technical skills and personality traits was an interesting finding. Even though, participants were able to define employability, they could not seem to list specific employability skills, and certainly could not differentiate between employability skills, technical skills and personality traits.

4.3. Enhancing participants' employability

Participant's attempt to enhance their employability took several forms such as volunteering, paid part-time work, unpaid work experience, industry mentorship, networking, military service and learning a language other than English.

4.4. Perceived employability

On a scale of zero (not at all confident about employability) to five (absolutely confident), four students indicated they were 'absolutely ready' for work. One student reported level four on the scale, while another student chose one on the scale. The rest of the participants (12) scored around the middle. Participants who indicated level five had all gained work experience. Where participants indicated a lower score, they lacked practical experience in the field of their studies. The rest of the participants reported different issues resulting in a self-score of three. These were visa constraints, family issues, the desire to pursue further studies and lack of work experience.

4.5. Career goals

The individual career goals of participants were listed as follows. Four participants wished to become the owner of their own business in the fields of finance, taxation, interior design and hospitality. The other career domains were banking, taxation and accounting, marketing, hotels, airport, tourism, construction industry, transport and logistics or human resources. Participants were also asked to share their desired career goals for the future. They had a plan of progression to start working for an organisation of their interest, then move on to a management position in five years' time, and finally to become a general manager or owner of business in ten years' time.

4.6. Universities' role in students' employment

Participants' perceptions of universities' role in enhancing employability were diverse. In general, they reported they gained firm foundations in theoretical knowledge and critical and analytical skills. They also highlighted team work, case studies, real life examples, guest speakers and the work of career services as important components. They wish to engagage, however, in more internships (during and at the end of the degree) and professional activities to put theory in practice. Participans also expressed the need for more social events, whereby they can increase the size of their network. Curiously, while they wish to obtain volunteering opportunities, participants have done nothing to engage in such activities.

5. Discussion and conclusion

There were five major themes that emerged from this study. First, participants were unable to differentiate between employability skills, technical skills and employability skills. Even though both skills and attributes are important for employers when it comes to selecting and promoting their employees, there seemed to be some confusion about the meaning of the terms. It can be speculated after the review of the literature, that a possible cause of confusion might stem from the terms employability skills and work-readiness skills being used interchangeably. Work-readiness skills tend to include attributes such as honesty, strong work ethic, creativity, flexibility as well as skills, for instance, interpersonal skills, team work skills or technology skills (Ahmad & Pesch, 2017). Employability skills, on the other hand, are more focused on competencies as outlined by the Core Skills for Work Framework (Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education and Department of Education, Employment and Workplace Relations, 2013).

Second, social skills were reported to be important especially for participants from China. Respondents explained that their career progression is not only dependent on who they know, but also on their parents' professional network. Networking and getting to know fellow

students were reported to be beneficial activities. However, these respondents also expressed their uncertainty in networking in a Western context.

Third, the role of previous work experience was an important contributor to students' perceived level of employability. Those participants who ranked themselves higher compared to the others had reported previous work experience and they also had employment secured after graduation. The other respondents who ranked their confidence in employability lower indicated diverse reasons such as the dominance of theoretical knowledge over practical application, the desire to pursue further education and the lack of work experience.

Fourth, the desire to include more practical components of the degree was expressed. Participants expressed their need for putting theory into practice and including more practical components in the degree program. As only two respondents engaged in employment close to their career desires, it is safe to state that respondents did not engage in extra-curricular activities to develop their professional identity in their dream career. Respondents in this study were more likely to wait for the University to do something to further their career goals, instead of taking the initiative, themselves. Ironically, self-initiative is one of the employability skills listed by the Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education and Department of Education, Employment and Workplace Relations (2013).

Fifth, the application of the subject matter was a recurring theme. In the order of frequency, the following desires were expressed: internships and projects with industry involvement; on-course internships project work; on-site visits; observations and guest-speakers from different industries; job-specific extra-curricular workshops; social activities; and the opportunities for improving presentation skills.

The practical contributions of the study can be conceptualised in the components and supporting factors of employability in the university context. The components of employability are employability skills, industry-specific technical skills, and academic foundational knowledge. The supporting factors include social activities, engagement with industry professionals, and academic support provided by the higher education institution. These findings call for curriculum considerations and a close collaboration amongst stakeholders who are focused on graduates' employability. Bringing more industry professionals into the classroom, taking more students out on field trips, workplace observations, work-shadowing, or career events require educational institutions to work closely with industry professionals. Conversely, students need to take and/or create the opportunity to put everything they studied into practice. Enhancing their employability starts with students' willingness to do so. These issues would make for relevant, fruitful research projects for future studies.

Acknowledgments

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Beyond Attrition and Retention: Working With Students to Enhance the First Year Experience

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Abstract

Student retention and attrition rates have been established as Key Performance Indicators (KPIs) for course teams in the Higher Education landscape in the UK. Against this quantified (and neoliberal) auditable undertaking, in this paper we offer an examination of a set of alternative qualitative efforts which are intended to improve the first year student experience by helping students transition into their course, and university life more generally. Working with students to enhance the first year experience is at the centre of our ontological position and we draw heavily on the idea of a "long thin" induction which continues throughout the first year at university. We explore the benefits of facilitating 'students as producers' and incorporating 'student intelligence' into university teaching and learning practices before presenting a series of activities that are designed to help students transition successfully and build a strong course identity. Having offered students different ways of structured integration into the course we reflect on how these activites can help first-year students develop the kinds of skills and knowledge base that contributes to a better experience of the transition and acculturation into university life in all of its facets.

Keywords: transition; games-based learning; students as producers; induction; mentoring.

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). Student attrition costs universities in terms of lost revenue whilst also not reflecting well upon the institution (Yorke and Longden, 2007). Whilst non-continuation rates for undergraduate students vary according to discipline, a range of factors - both endogenous and exogenous - to the university itself are important.

Drop out rates in social studies across the UK are at 5.7% (the same as law) (HESA, 2018). For the subject of sociology continuation rates (at the same institution) have been consistent between the years 2003-4 and 2012-13 at around 89% (HEFCE, 2018). Russell Group universities have generally lower non-continuation rates (below 4%) where post-1992 institutions have higher ones. From 2015-16 entrants, Leeds Beckett University retained 84.8% students (11.8% left HE altogether, the remainder transferred to another institution) (HESA, 2018). For a variety of reasons, including the fact that the university has a higher proportion of students from disadvantaged background (as calculated by the POLAR system), 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 on enhancing the first-year student experience, particularly the level of integration, connectedness, and involvement with the course and the ways in which this is an important determinant of their academic persistence and success (Yomtov et al., 2015). Thus, this paper charts how we have attempted to collaboratively address these concerns through staff-students projects exploring how the transition to university life might be smoothened through game-based learning, resulting in an 'extended' 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). Lack of perceived social support has been linked to the likelihood of students to drop out. 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 ¾ 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, Yorke and Longden (2007) 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. 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).

These findings have led us to focus on incorporating student intelligence and experience into the production of a range of induction activities that are broadly aimed at enriching the first-year student experience. Our aim has been to build a strong course identity - feelings of inclusion and involvement in the course - through establishing greater student peer

relationships and developing staff-student collaborative projects that provide a genuine opportunity for students to shape the learning and teaching stratgegies on their course.
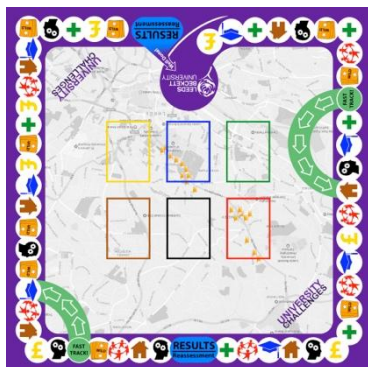
3. Students as Producers of Games

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.

Unlike lecturer designed games, we priortised our students' experiences in giving them the task to design a game that could be played during induction 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 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.

4. The Transition Game

'University Challenges' is an interactive, competitive and collaborative board game (Figure 1) in which students attempt to accumulate credits by moving around a board and be the first to 'pass-progress' (to the second year) to thereby win. The game is built on a games-based learning paradigm which, in this case, is not about using 'serious games' to provide learning opportunities for course content. Instead the game aims to provide learning opportunities around the transitional aspects of becoming a learner in a contemporary

Higher Education system. The game therefore mirrors some of the structuring aspects of first year student life requiring each group/team to complete six modules of the course structure in order to reach the goal 'pass-progress'. This refers to the exam board terminology used at our university to indicate a student's entitlement to proceed into the second year of study.

Figure 1: The University Challenges Board Game

Equally significant, the game allows students to become accustomed to aspects of student life through a mixture of luck and problem solving components, which intend to increase their knowledge and strengthen collaboration and social connections amongst first-year students. Our peer-competitive board game introduces students to the specificities of becoming a student and is organized around six key areas of student life identified by student game designers, namely: having to manage one's own finances, dealing with accommodation issues, establishing new social connections and maintaining old ones, social and peer aspects of being a student, knowledge about wider health and safety aspects and, finally, academic conventions and frameworks as they affect students.

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 is played during a long induction process that addresses issues new students face offers a range of potential social 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.

The game is in its third year of being played and the cohort from 2018-19 played it in induction week. 80.7% felt the game provided useful information about the university which was embedded into the game. In relation to social integration 84.4% students felt it was useful for meeting other students and 73.6% thought it was useful for (starting) to build

new relationships. Equally, the collaborative aspects were valued by 77.2% of first year students and 65% thought it contributed to a sense of belonging to the course. Given this was a one off intervention in induction week it is perhaps more useful to point out that new first years were impressed with the fact that previous students had designed the game and most liked 'hearing real life advice from the third years'. Other aspects they most liked about the game were: 'getting to know other students', 'talking to peers' and the fact that 'Nobody was scared to speak up because it was in the context of a game rather than a group of strangers'.

However, group wide single interventions are limited in their scope and impact and thus are best utilised as part of a of suite of interventions aimed at embedding students within their course. Other meachanisms to foster first years' integration, connectedness, and involvement with the course and their peers occurs through an 'away day' during our 'sociology festival week' in week 7 of teaching during which students walk in groups with tutors to an Industrial Museum where teaching activities take place. The walk provided a non-campus based opportunity to socialise with other students and also, importantly, engage in some bodily exercise; something that is inceasingly being recognised for having a contribution to wellbeing which can be framed by theories of restorative environments and therapeutic landscapes (Bornioli et al., 2018). Further tasks designed to foster students' connectedness and involvement are group projects carried out during the first semester, one of which is also tied to a reflective task on the learning progress of students – the contents of which are also used to advise students in need of the existing mentoring programme.

5. Peer Mentoring

A peer mentoring programme was piloted in 2017 and has been rolled out more widely within the sociology course. Contrary to the skills focused library mentoring programme in existence a more course focused mentoring programme has the benefit of matching students with peers from within their course, thereby strengthening the connectedness to the course itself. In doing so we follow the idea that a peer mentor is someone who provides support, guidance and practical advice to a mentee who is close in age and shares common experiences and characteristics through intentional matching (Beltman and Schaeben, 2012).

The mentoring scheme is voluntary for both mentors and mentees and in the past year 12 mentors have been trained to support and guide students in lower years. Despite an initial call for first year students to opt into the mentoring scheme, only 8 students (of a cohort of 120) applied (and were matched with a mentor). This is not surprising given that evaluations of mentoring schemes point to difficulties in take up or maintenance of mentoring relationships on behalf of potential mentees (Andreanoff, 2016). Thus, in

response, an adaptive approach to the mentoring scheme was employed (which is still in progress) whereby students who express (such as in their reflections) or exhibit difficulties during the semester are approached with the suggestion to get assistance from a mentor. This approach has resulted in 10 more students engaging with the mentoring scheme and early evaluations suggest that both mentors and mentees find the scheme beneficial.

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 multimodal interventions and activities are designed so that the diverse body of students who start the course can engage with several activities which can help connect, engage and support a wide array of students, many of whom are increasingly arriving with mental health issues. Peer-to-peer activities also allow students to build their own tacit knowledge and experience of transitioning. Along with gaining deeper knowledge of 'student life', it is our contention that our various activities 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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Constructing "New Liberal Arts" in China's Universities: Key Concepts and Approaches

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Abstract

Inspired by the concept of "New Engineering" in China's universities and considering the features and values of the humanities and social sciences, this paper discusses issues of constructing "New Liberal Arts" in China's universities. Firstly it states the general characteristics of the humanities and social sciences that find their realization in "New Liberal Arts", and the qualities of "New Liberal Arts" such as being strategically important, innovative, integrated and promising. Then it proposes that a cluster of first-rate undergraduate programs with Chinese characteristics and global competitiveness be set up. The paper finally suggests new ways in which "New Liberal Arts" are to be constructed, such as to recognize new research objects, new research paradigms and new social needs of the humanities and social sciences, to break through conventional thinking stereotypes, and to do well in five aspects -- concept reconstruction, structural reorganization, model regeneration, platform building and differential development. In so doing, the paper is hoped to provide useful considerations for universities elsewhere.

Keywords: the humanities and social sciences; New Liberal Arts; construction; universities; China.

1. Introduction

The humanities and social sciences are important means by which human beings understand and transform the material world, and they are also vital forces to push history forward and bring about social progress. Just as Chinese president Xi Jinping pointed out at the Symposium on Philosophy and Social Sciences on May 17, 2016, "A country without developed natural sciences cannot rank in the forefront of the world, nor can it without prosperous philosophy and social sciences." In order for China to train ethical professionals who are socially responsible and know how to meet the challenges of working in their fields in the best manner possible, both "New Engineering" and "New Liberal Arts" are necessary in China's higher education. Wu Yan, Director of the Department of Higher Education of China's Ministry of Education (MOE) said at the "2018 MOE Meeting on the Industries-Academia Collaborative Talent Program" that China will comprehensively promote the construction of "New Engineering, New Medicine, New Agriculture, and New Liberal Arts" to form a cluster of first-rate undergraduate programs covering all disciplines with Chinese characteristics and global competitiveness.

Internationally, Altbach (2016) summarizes the global trends of higher education as: a growing private sector, a deterioration in the quality of education, more distance education, increased efforts to measure academic productivity, attempts to assure quality, differentiated academic institutions with varied missions, and an industry of student mobility. Against this background and apart from successful examples from the developed world (see for example Keller, 2014), more universities worldwide become increasingly concerned with providing revised curricula in response to social change. For example, Olvera (2015) describes the transition and advance at the School of Accounting and Administrative Sciences of a Mexican university through different stages of curricular design, from the needs evaluation and diagnosis up to the proposal of the final format. Similarly, Hu (2015) did a case study of the tourism management program in China's Guangdong Province, stressing the building of an integrated learning situation for liberal arts graduate students. In this context, the present paper will discuss a relatively new concept in China's higher education -- the construction of "New Liberal Arts" -- by proposing some strategies and approaches to this construction.

2. Categorization and Characteristics of Liberal Arts

In the Chinese academia, "liberal arts" is understood as a general term that covers all the disciplines in "the humanities and social sciences", with "the humanities" specifically concerning the studies of ideas, feelings, emotions and values of human beings and "social sciences" concerning various social phenomena and their law of development. Therefore, "the humanities" cover such disciplines as literature, history, philosophy and the religions,

ethics, arts and so on, while "social sciences" encompass economics, management, education, law and their branches including political science, sociology, ethnology and so on. In the Chinese context, there is another term, "philosophy and social sciences", that is also used to refer to "the humanities and social sciences". Despite all these different terms, however, "liberal arts" normally include disciplines like philosophy, economics, law, education, literature, history, management, and art. This is based on the categorization made on the *Catalogue of Undergraduate Programs in China (2012)*, which puts science, engineering, agriculture and medicine in parallel categories.

Since it usually takes several generations to understand human development and to continuously accumulate and develop knowledge, the humanities and social sciences are characterized by strong historical inheritance and knowledge accumulation. In terms of their objects of research, issues in the field of politics, law, ethics, art, religion, and philosophy are investigated in the way that bear the marks of ideology, class and nationality. As to the subject of studies, researchers do not only pay attention to social reality, but attach more importance to value judgment, which is closely related to their life experience. The purpose of such researches is to enrich the spiritual world of human beings and to transform their social practice, which also has a lot to do with value judgment.

3. Necessity of Constructing New Liberal Arts

If science education is a process of seeking truth, liberal arts education is a process of seeking virtue and beauty. In the process of building up a personality, liberal arts education enables individuals to consciously and actively have a correct understanding of themselves and the society at large, and to train them in thinking correctly and independently. Liberal arts education cultivates the humanistic literacy of individuals so that people can properly handle their relationships with nature and with social groups and enhance their ability of survival and communication as social beings.

Due to utilitarianism in educational ideas, however, some Chinese universities haven't paid due attention to courses in the humanities, which are either given insufficient lecture hours or marginalized. These universities offer courses of the humanities without being clear about their function, and their curricula are extremely similar without distinct features, neither can these courses adequately respond to the important theoretical and practical issues of today. Consequently the students are restricted in their vision, awareness of innovation and the ability to apply what they learn.

"New Liberal Arts" is different from such arts education and attempts to innovate the traditional liberal arts. It is set against the context of the world's new technological revolution and the new era of socialism with Chinese characteristics. Breaking through the thinking patterns of traditional liberal arts and by means of inheritance and innovation,

crossover and integration as well as collaboration and sharing, it attempts to promote in-depth interdisciplinary integration, to accelerate the upgrading of traditional liberal arts, to shift from being discipline-oriented to being demand-oriented, from isolation of programs to cross-integration, and from being "driven" to offer adaptive services to social development to playing a "leading" (Giannakou, 2006) role in it. Apart from the general characteristics of the humanities and social sciences, "New Liberal Arts" possess the following new properties:

First, it is strategically important. This is precisely the value of new liberal arts. The construction of new liberal arts is supposed to help China cope with the complicated situations home and abroad, to promote Chines discourse in communication with the international community so as to offer service to China's comprehensive economic and social reform, and to solve the major theoretical and practical problems in people's values and ideas.

Second, it is innovative. This is the attribute property of the new liberal arts. The construction of the new liberal arts is supposed to seek new breakthroughs in the humanities and social sciences, to find new growth point of disciplines, so as to transform and upgrade traditional disciplines and to achieve theoretical innovation, mechanism innovation and mode innovation.

Third, it is integrated. This is the disciplinary property of the new liberal arts. The construction of the new liberal arts can be made possible by the integration, infiltration or expansion of many disciplines within the humanities and social sciences, or by integrating the humanities and social sciences with other disciplines, such as with science, medicine and engineering.

Fourth, it is promising. This is the dynamic property of new liberal arts. Needless to say, many new things are to appear that need to be explored in the field of humanities and social sciences. Besides, many new problems are constantly emerging with social development, and there is no fixed mode for solving the problems. Therefore, it is necessary to make constant explorations, adjustments and improvements in the course of social practice.

4. Approaches to Constructing New Liberal Arts

To construct the "new liberal arts", a profound understanding of the development law of humanities and social sciences is necessary and, at the same time, the issues concerned must be investigated thoroughly. In order to reach a consensus of the construction of New Liberal Arts among universities and the general public in China, we propose some concepts and initiatives.

4.1. Key Concepts

First, the new liberal arts emerges from the innovation of new industries. In the new round of technological revolution and industrial transformation, a large number of technological fields are emerging, such as artificial intelligence, block chain, genetic engineering, virtual technology and so on. One of the important contents of the new liberal arts will involve adapting humanities and social sciences to China's national strategy of "empowering the country with science and technology", and integrating arts with the emerging fields of science and engineering. For example, as automated driving technology develops, it is necessary to study the laws and public policies related to this technology and social issues caused by this technology.

Second, the new liberal arts is brought about by the transformation of traditional research paradigms. Along with the popularization of the big data technology, the analysis and processing of the full sample data in humanities and social sciences has brought new convenience in solving the problems of economic and social development and people's ideological change, hence bringing new growth points to liberal arts. One focus of new liberal arts research will be social science subjects based on programming, acquisition and processing of big data and artificial intelligence technology, such as machine learning or knowledge map.

Third, the new liberal arts is brought about by social development and change in people's needs. As the development of the human society and people's intellectual life results in new demands in different fields and industries, the new liberal arts will inevitably involve the fields related to artificial intelligence, such as intelligent law, intelligent political science, intelligent sociology, intelligent ethics, intelligent journalism, intelligent education and so on.

4.2. Approaches

4.2.1. Concept Reconstruction

China's educational practice and theoretical innovation are carried out with an aim of training the students to have a global perspective and at the same time to be firmly anchored in the Chinese culture. Therefore, China's education ought to remain "student-oriented" and take root in the land of China, highlighting the characteristics of the new era and an international perspective, and cultivating students who love their homes and nation while having a global vision (Ramirez, 2006: 125). A university is an institution of educational operation and therefore should be given full autonomy. Universities should be encouraged to reform their operating modes and mechanism, and good examples of running a university should be legitimately acknowledged.

4.2.2. Structural Reorganization

In order to adjust the structure of programs in the humanities and social sciences in universities, we should make a good incremental plan, set up new programs of the "New Liberal Arts", follow the law of education and the law of disciplinary development, and explore ways to establish frontier and scarce disciplines and disciplines that are in urgent need. For example, some work should be done to develop interdisciplinary studies by integrating the construction of new disciplines and crossover disciplines into the systematic construction of humanities and social sciences with Chinese characteristics. It is necessary to adjust the disciplines at stock and speed up the upgrading and transformation of traditional disciplines, for instance, by adapting economics and management to better address major issues concerning national strategy and social development, such as energy, ecological and climate issues. It is also important to do a good job in the integration of disciplines and apply a problem-oriented approach in social researches (Nwaka, 2000). Take the study of regional issues for example, national strategies such as the Belt and Road initiative can be brought to regional (ethnic) studies, and comprehensive studies can be carried out from the perspectives of linguistics, political science and economics.

4.2.3. Model Regeneration

On the basis of reforming the traditional way of talent training a new type of training model should be created to meet the needs of students' growth. First, to ensure the standards for judging the quality of liberal arts education. Comparative studies should be made between China's national standards for teaching quality of all university programs and the corresponding standards in other countries, so as to revise and adjust the programs to bring about a quality system and monitoring system which not only meet the needs of the new era but also demonstrate the distinctive character of a university. Second, to build a cluster of interdisciplinary curricula. Oriented by knowledge and themes and going beyond disciplinary chauvinism, a university should enable students to have multidisciplinary perspectives and a unique way of thinking and a university should endeavor to turn out the "T-shaped" innovative talents who know both extensively and intensively about a certain field. Third, to explore a model of instruction with an open curriculum. Restructuring the curriculum is expected to carry out based on achievement-oriented and question-based learning concepts, when curriculum knowledge points are sorted out, and scientific achievements and new technological measures are applied. And a mechanism of collaborative education should be set up in which industries and research institutions may get involved in education, and a university may collaborate with businesses or foreign universities.

4.2.4. Platform Building

Platform building involves the overall planning and top-down design of the construction of the New Liberal Arts. First, in terms of organization, disciplines should collaborate instead of being isolated. A university should set up interdisciplinary research centers, research plans and curricula based on research topics, and establish a fully integrated academic structure with no "walls". Second, in terms of management, a university should be administrated in a way that is flexible rather than rigid. It ought to break through the original definitions of colleges, departments and programs of undergraduate education, restructuring the framework of disciplines and programs, and shift from the traditional rigid mode of instruction to an autonomous learning model which is more flexible, customizable, like a menu. Third, to shift the institution from constraint to encouragement. A university should eliminate the restrictions on discipline construction, and reform research evaluation policies, curriculum and talent training mechanism, as well as regulations of fund operation and administration. An open and sharing mechanism of liberal arts should be built, which is conducive to construct and guarantee innovation in interdisciplinary studies.

4.2.5. Differentiated Development

In the construction of New Liberal Arts, universities of different types are not supposed to work in a way of rigid uniformity. Universities with traditional liberal arts should give full play to their advantages of being closely related to the industries, and promote the interdisciplinary studies within liberal arts. In this way can they strengthen the construction of the neglected and marginalized disciplines which are urgently needed in the national strategy, highlighting their advantage of being large and strong in the agglomeration of liberal arts. Universities with liberal arts and natural sciences (including engineering) enjoy their disciplinary advantages of being comprehensive, so they should focus on the national development strategy and facilitate the borrowing and lending of strength between liberal arts and other disciplines. They should highlight their advantage of being strong and specialized with Chinese characteristics by innovating their mechanism and developing their disciplines. Universities of science and engineering should concentrate on the interface between science and engineering and humanities and social studies, and pay close attention to the complicated humanistic values in some industry domains, and highlight their advantages of being outstanding and distinctive in the humanities and social studies. Local colleges and universities should make full use of their regional advantages and focus on the needs of local economic, social and cultural development. Their goal of constructing liberal arts is to meet the local demands, so it is necessary for them to engage in sound and solid development in promoting the transformation and upgrading of traditional liberal arts.

5. Concluding Remarks

Today's multi-polar world is undergoing economic globalization and a revolution of information, which leads to a culturally diversified in-depth development and intense ideological and cultural exchanges in the world. China is in such a world. Since China began its policy of reform and opening up in 1978, new situations and new problems have emerged in China's economic system, social structure, as well as people's ideas and pattern of interest, and various ideological trends have been on the rise one after another. There have been increasingly frequent academic exchanges and dialogues between China and the world. Under such circumstances it is urgent for Chines universities to play a better role in developing the humanities and social sciences. It is hoped that after doing some substantial work in concept reconstruction, structural reorganization, model regeneration, platform building and differentiated development, New Liberal Arts will be given due attention and implementation in universities in China, featuring a cluster of first-rate undergraduate programs with Chinese characteristics and global competitiveness.

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Navigating curriculum transformation: charting our course

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Abstract

The 2015 student-led #FeesMustFall campaign in South Africa initiated at some universities, and accelerated at others, indepth discussions and reflections about curriculum transformation within the perceived ivory towers of learning. Three years later, the mandate to implement transformation is clear from all levels but what is uncertain is the operationalization of the official transformation framework at the University of Pretoria. The aim of the project presented is to chart the process followed by one of the four Schools of the Faculty of Health Sciences to deconstruct this transformation framework. As part of a three phased programme, a workshop of diverse staff using a modified nominal technique was held in 2018. It resulted in a visual tool of 19 specific statements considered evidence of personal practice that supports and advances the drive for transformation. This tool will be used to share practices and instil individual and School accountability for everone's role in curriculum transformation. In conclusion, complex policy ideals and technical terminology can be translated into practical, appropriate actions by a diverse group of staff and students. The use of a modified nominal group technique was an efficient way to do this by generating an easy-to-use visual tool.

Keywords: Curriculum transformation; epistemology; pedagogy; classroom practices; institutional culture; capacity building.

1. Introduction

In mid-October 2015, South Africa was confronted with intense student-led and citizen supported protests against the rising and unaffordable exclusionary fees as well as the lack of sufficient progress towards transformation within its Higher Education Institutions (HEIs). This #FeesMustFall campaign initiated at some HEIs, and accelerated at others, the discourse around transformation within the perceived ivory towers of learning (SA.DHET, 2017; CHET 2017). Three years later, the mandate to implement curriculum and broader transformation is clear from the Department of Higher Education and Training (Cloete et al, 2017), and society. The mandate has permeated down to our own setting, the School of Health Systems and Public Health (SHSPH) in the Faculty of Health Sciences at the University of Pretoria (UP). What is not clear are the day-to-day actions that all staff need to undertake to contribute towards these transformed spaces.

This paper reports on the the four drivers of the University's curriculum transformation framework and the process followed by the SHSPH to deconstruct, interpret and internalize this official framework. The outcomes of this process – a visual tool – that is contextually appropriate and grounded in our own understanding is presented .

2. Transformation framework

In response to the national agenda for curriculum transformation in institutions of Higher Education, the UP developed a framework to drive the agenda within the University. After extensive consultations with both external and internal stakeholders, four curriculum transformation drivers were identified (University of Pretoria, 2017). The intention is to use these transformation drivers as lenses through which our current practices can be interrogated and new approaches shaped.

The four drivers with summarized descriptions include: 1) Responsiveness to social context: a transforming curriculum that responds to local and global contexts, histories, realities and problems; 2) Epistemological diversity: bringing marginalised groups, experiences, knowledges and worldviews emanating from Africa and the Global South to the centre of the curriculum; 3) Renewal of pedagogy and classroom practices: responsiveness to and training in new pedagogical methodologies and approaches within disciplines and finally, 4) An institutional culture of openness and critical reflection: exposing and resisting the subliminal practices of the hidden curriculum that are part of South Africa's legacy of discrimination.

All faculties within the university were tasked to develop plans demonstrating how they would use the identified drivers to transform the various curricula.

The Faculty of Health Sciences is comprised of four Schools (Dentistry, Healthcare Sciences, Health Systems and Public Health, and Medicine), each of which has a unique history, structure, culture, ethos and vision for the future which influences the way in which the members of each understand, approach and conceptualise their curriculum transformation journey. The Faculty tasked its Teaching and Learning Committee (TLC) with members representing each School to develop specific transformation plans for their programmes and needs. One of the activities in the plan for the SHSPH was to engage academic and support staff in the School, to create awareness and get a 'buy-in' about the four drivers that would guide our curriculum transformation.

3. Method

The SHSPH TLC members devised three phases to the programme 1) pre-workshop dissemination and sensitization to the drivers of the official university document with materials posted in the tearoom and circulated electronically two weeks prior to 2) the workshop of academic and administrative staff (to be described in greater detail below) and 3) a post-workshop reflection session of the committee. The entire programme was conducted from December 2017 to March 2018.

The following strategy was used for the workshop. After a brief welcome, each TLC member briefed the participants on the meaning of one driver term. An adapted nominal group technique (NGT) of four mixed groups [academic staff (n=16), senior students (n=5) and administrative (n=5) staff] with an assigned TLC staff member (including the education consultant of the Faculty of Health Sciences) was created to ensure that perspectives from different levels of staff was included and focussed towards the workshop's overall outcome of a core list of practical ways of implementation towards transformation at the SHSPH.

The NGT, as originally developed by Delbecq and vandeVen (1971), is a structured method for brainstorming in group context where there is a diverse group of participants. A NGT eliminates power imbalances (for example, due to role, seniority, or gender) in the room, encouraging the uninhabited sharing of thoughts (Roets and Lubbe, 2015). It further aids in problem identification, generating a variety of solutions as well prioritization and decision-making in a group-context thereby giving voice and choice to all participants.

Each group was therefore responsible for a driver term and was provided with flipchart and markers and an envelope of instructions, including a copy of the official transformation document. They were given 15 minutes to compile at least six practical activities relating to their driver term. During the NGT-session, group presentations was done where the flipcharts was displayed, which resulted in the identification of common understandings and a plurality of suggestions. Due to time constraints of academic staff and to ensure that the environment remained focused but lighthearted, the technique was modified where

informal tallying was done with each person in the room (excluding the TLC members) being given three sticker dots to vote on each driver's activities. Consensus was thus not the aim of the NGT, but rather to generate and prioritise a variety of strategies that can be suggested for implementation depending on the didactic and personal approach of the individual.

The project was concluded a week later with a quality assurance step by the TLC to ensure the items that were voted on were extracted and that the language was clear. Items that were related to the Faculty (rather than the SHSPH) were not included (these strategies were shared with Faculty via the internal structure).

4. Results

The study resulted in 19 specific statements considered evidence of personal practice that supports and advances the drive for transformation. A non-specific statement (other) was added to each of the four drivers in order to stimulate innovation and allow for variances in job descriptions (See Figure 1 for an anonymized version of the "star chart").

Figure 1. Extract of the star chart of transformation (2019).

The four drivers and the associated statements are:

Responsiveness to social context (n=3)

- I include and encourage sound ethical principles, behaviour and advocacy in my modules and conduct

- I engage in discussion about social issues

- I participate in School and/or Faculty community outreach, transformation and awareness activities

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Epistemological diversity (n=4)

- I use contemporary African examples, content and context in my teaching /facilitation (e.g. readings, case-studies, open education resources [OERs] etc.)

- I contribute to and/or create content related to the Africanisation of the curriculum e.g. by creating and sharing OERs such as YouTube videos and publishing in open-access journals etc.

- I value other knowledge-base systems

- I use and encourage students to use local resources (eg. websites, books etc.)

Renewal of pedagogy (n=7)

- I use different student-centered teaching approaches (eg. case-studies, problem-based learning etc.)

- I promote practical problem-orientated teaching and learning

- I use the post-module student feedback to improve my module's content and mode of delivery

- I use clickUP *(the university's learning management system)* for active student engagement

- I use clickUP to share teaching resources and communicate with students

- I am continuously developing myself by attending at least four teaching, learning and assessment-related training opportunities per year

- I adhere to all time deadlines for module coordination

Institutional culture (n=5)

- I get to know students in the modules by using different approaches

- I promote/market the School's successes and students (current and alumni) by using different approaches

- I create opportunities for students to get to know each other and those working at the School

- I have an open door communication policy

- I support and/or contribute to School seminars, PhD presentations etc.

5. Discussion and conclusion

The use of the modified NGT was a simple but effective method to deconstruct the transformation drivers, stimulate discussion about what these drivers mean in practical terms and develop an understanding of both the purpose and practice of these drivers in our context. The activity also resulted in a visual tool and commitment to transformation, against which the academic and administrative staff can be held accountable. The benefits of using this method included team-building and interdisciplinary participation despite the time limitation.

Complex policy ideals and technical terminology can be translated into practical, easy-to-understand actions by a diverse group of staff and students. The use of a modified NGT was an efficient way to do this and to generate a visual tool that is easy to use. Once field tested, the statements could be considered for formal inclusion in staff's performance agreements. This paper reported on the development of this tool, but what is not yet known is whether the use of this tool will translate into the desired transformation. Measuring the effect of this tool should be the focus of future work.

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Management of wastewater trough theatre

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Abstract

Compulsory study course on wastewater treatment and sewage systems contains lectures, classroom calculations, technical project and laboratory practicum. The course is addressing not only the developing skills in wastewater treatment technologies but also provides preparation of professionals that can communicate with institutions involved in water and wastewater sector. Over the years it has been observed that even after receiving the most sophisticated knowledge and highest markings, students often lack skills in practical communication with industry and implementation of theoretical knowledge in praxis. Here we describe student-centred teaching method that is based on the activities that are similar to theatre and allow: (i) the teacher to find and understand the weaker places in student knowledge gained during the semester; (ii) the students to form professional skills during the active communication with colleagues and mentors from industry. The students work in several groups "INDUSTRY", "MUNICIPALITY" and EXPERTS", try to find better solution for industrial sewage treatment and cooperation model with the municipality and present their results. After 2 years of the modernisation and adjustment, the training course has created an interest not only from student side but also from the industry representatives that are interested in communication with the new specialists and develop strong contacts with the university.

Keywords: student-centred teaching; team work; wastewater management.

1. Introduction

Conventional opinion is that a teacher is a person who helps others to acquire knowledge, competences or values (NGSS Lead States, 2013). From one side this role may be taken by anyone, but not anyone can acquire competence and to grow interest for the field. There are several methodologies that are based on the training through the activities or games. This approach is regarded as a modern interactive method of training, which should encourage interest in the selected profession (Yakovleva&Yakovlev, 2014). The two most often mentioned models in literature sources are teacher-centred method and student-centred approach (Joyce et al., 2014, Glater et al., 2016, Schreurs&Dumbraveanu, 2014). Teacher`s choice of selected work model depends on their philosophy, subject area and other factors (Garret, 2008, Joyce et al., 2014). The teacher is the main authority figure in teacher-centred models (Alam, 2013; Gill, 2013, Glater et al., 2016). Students receive information and give evaluation through the tests and exams. In student-centred approach, both teacher and students play active role. This model provides more informal environment and students' work through various projects, presentations of ideas or discussions. Nevertheless, implementation of different technologies, such as, computers, interactive whiteboard, Internet or some specific technological models in any of the two models in the study process makes it more interesting and modern.

Institute of Heat, Gas and Water technologies (SGUTI) is a part of Faculty of Civil Engineering at Riga Technical University (state founded non-profit and accredited higher educational establishment of the Republic of Latvia) and consists of two departments: 1) Heat Engineering and Technology and 2) Water Engineering and Technology. Both provide all level higher education and carry out research in the field of heating, ventilation, air-conditioning, water and wastewater treatment systems, water distribution network and sewage collection system.

Compulsory study course on wastewater treatment and sewage systems (course number BUK310) in SGUTI includes lectures, classroom calculations, technical project and laboratory practicum. In addition to the development of skills in wastewater treatment technologies, the course also:

1) addresses the main problematic sources and contents of the industrial effluents and their possible impacts on conventional treatment process at municipal WWTPs;
2) identifies the existing practices, challenges in institutional capacity, stakeholder cooperation, management models and legislative implementation regarding water utilities, industrial companies, permitting and legislative authorities;
3) development, demonstration and evaluation of new cooperation, management and working models on local level between the water utility, industrial companies and monitoring authorities.

It is aimed that BUK310 training will prepare professionals that can communicate with participating institutions of water utilities, industrial companies, municipal and regional authorities for more efficient process control, management and cooperation models, potential technologies and economic, environmental and social incentives. However, during the several years of work with students, it was observed, that students have a low understanding and evaluation capabilities of gained results after the courses. Thus, a modification in the existing teaching method was made to grow practical understanding, skills and knowledge in the field of wastewater management through the communication with professional mentors and representatives from relevant industries.

2. Methodology

The introduced teaching method is aimed to develop skills and knowledge in the field of wastewater management. This method is based on the activities that are similar to theatre and allow: (i) the teacher to find and understand the gaps in student`s knowledge gained during the semester; (ii) the students to generate professional skills during the active communication with colleges and mentors. There are several steps before organization of training though the theatre:

1. Learning of the basic study material throughout the semester (wastewater quality parameters, treatment technologies, sewage system, legalisation rules);
2. Professional excursions to different WWTP aimed to compare theory and reality, to see the difference in real systems;
3. Wastewater treatment plant (WWTP) and sewage system design and construction in the specific IT program.

For efficient performance, it is necessary to prepare a scenario and to find active mentors from the industry. It is important to remember that the training can take place for several hours (4-6 academic hours) or full day, depending on the scenario and persons involved. Usually 1-2 mentors are invited for a 20-person group of students, the responsible staff of training also gets involved as a mentor. It is recommended to use a room, where students can create a workplace for the teams themselves. Everyday materials, such as coloured markers, whiteboards, paper, are essential. Till some extent catering (drinking water, tea, sweats) is also essential to make the training day more casual and interesting.

Within this article one example of a scenario for 4 academic hour work with a group of 19 students and 2 mentors from the industry is described. The theme was tested in 2018 autumn semester.

2.1. Introduction for training

The teacher informs the students of training goals, hopes regarding activities and introduces to 3 mentors (2 representatives from industries and lecturer). Students form work groups:

1. 3 groups of 4 persons will represent industry (food, feed production or other);
2. 1 group of 4 persons will represent municipality of a small fast growing town in Latvia (relevant to any other country in EU);
3. 3 students will represent experts in the field of wastewater technologies and legalisation.

One mentor will coordinate the work of "INDUSRY" student teams, other – "MUNICIPALITY", third mentor – "EXPERTS".

2.2. Order of the training

The invited mentors start the training from the presentation about the represented industry: what kind and amount of products their produce, amount of wastewater, how successful is the communication between their industry and municipalities in their district. If mentors represent municipality, they present wastewater collection and treatment system, its scheme, loads and restrictions for the collected wastewater. Presentation time is limited for 15 minutes per mentor.

The teacher informs the students about the goals for each team (time limit 15 minutes):

"INDUSTRY" team should choose the type of production (example, cheese, milk, pharmacy, chemical industry). After a discussion time of 45 minutes, each team should present their selected industry. They present wastewater quality parameters and their decision about the wastewater management, including the following points: is it planned to build a WWTP to treat the industrial wastewater; will a pre-treatment stage be included and what kind of cooperation will be made with the municipality; or is it planned to have wastewater discharge into the sewage system of municipality.

"MUNICIPALITY" team should present their district and specific WWTP system and restrictions for the industrial wastewater with the clarification why these restrictions are made.

"EXPERTS" one per "INDUSTRY" team should communicate with the industry and municipality and try to help to find better solution for wastewater management.

During the discussion time the best technology for industrial wastewater pre-treatment should be selected from the perspective of all involved parties. The students can use all Internet resources, course materials to find wastewater characteristic parameters for chosen type of industry and systems used for treatment of this specific type wastewater. All teams can take consultations from mentors.

Final part of the training is the presentation of the developed results, discussion aimed to setting up guidelines for a better management of industrial wastewater and conclusions.

To present the results of the discussion students can use all available equipment (computers, interactive whiteboard or board with paper and marker). It is important for participants to divide roles to present the work could be by each member of the group.

Figure 1. Example of discussion process and presentations in class. Photo by Tihomirova (2018).

3. Discussion

Several years of practical and academic experience allows to recognize that the progress in water and wastewater management field depends on communication skills of all representatives that are going to cooperate. It is important to not only understand the legislation part of wastewater management or how the industrial or municipal wastewater treatment works, but also to understand the needs and resources to achieve an improved cooperation result. The practical application of knowledge gained during the theoretical studies should be trained in the universities.

During the study of BUK310 course on wastewater treatment and sewage systems (Table 1) students acquire skills via lectures, calculations, project and laboratory work. After course finalisation they are expected to have knowledge in wastewater treatment technologies, understand the main problematic sources and contents of the industrial effluents and their possible impacts on conventional treatment process at municipal WWTPs.

The modernised course with the workshop "Management of wastewater trough theatre" aids in development of communication and critical thinking skills for new specialists with the help of mentors from the specific field. Even if these professionals are not trained lecturers, their practical knowledge supports the theory learned during the classes and complements practical works (Table 1).

Table 1. Comparison of conventional and modernised teaching approach.

	Course		
	Compulsory	**Modernised**	**Gain knowledge**
Lectures	+	+	Basics of wastewater treatment proceses and legalization
Calculations	+	+	Basics of mechanisms of proceses
Course work	+	+	Engineering calculations for full cycle of wastewater treatment process
Technical visit	o	+	Comparison of real system with gained basic knowledge
Workshop	-	+	Communication skills
			Communication skills
			Critical thinking skills
			Team work
			Finding and evaluating research
Expert consultation	-	+	Communication skills
			Industry perceptive
Examination	+	+	

o - optional

The modernised course of wastewater treatment and sewage systems can be comparable with Problem-Based Learning (PBL) teaching method, that promotes the development of critical thinking skills, problem-solving abilities, communication skills and promotes working in groups, individual finding and evaluation of research materials (Duch et al, 2001). In this case the students are the active participant in the learning process rather that a passive receiver of information - they analyse a given problem, identify and integrate the obtained knowledge under the mentor guidance (Kleger and Hurren, 2011).

The tested approach "Management of wastewater trough theatre" includes not only training of communication or teaches how to ask the right questions and negotiate until the joint decision on the technology to be implemented has been made but also facilitates working in groups. "EXPERTS" team detects flaws in the used technologies and finds a better way to improve the technologies, evaluates resources and also tries to summarize the recommendations for collaboration among "INDUSRY" and "MUNICIPALITY" partners.

The described methodology can be used to educate engineers in various fields. It will help to develop communication skills of specialists with strong mathematical education. Therefore, with this methodology more effective modernization of the field will be made as result of correct communication.

4. Conclusions

"Management of wastewater trough theatre" is based on the activities that are similar to theatre and allow the teacher to find and understand weak places in student`s knowledge gained during the semester in order to fill the gaps. The students acquire professional skills during the active communication with colleagues and mentors from the respective industry. After two years since the modernisation has been introduced, SGUTI BUK310 course has created an interest not only from the students who gain more practical understanding about the requirements behind wastewater treatment but also from the representatives of the industry that are interested in communication with the new specialists and develop strong contacts with the university.

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New tools for teaching: educational cards for primary schools on the prevention of food waste

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Abstract

This article shows the results obtained from the creation of some educational cards for primary school pupils on the topic of the food waste prevention. The collaboration between designers and experts in the educational field was fundamental for this project: we combined the communicative and design skills of the designer with the didactics knowledge of the educators. The activities have been created on the basis of the experiential methodology, the pupils feeling themselves the protagonist of the activities, combining the traditional educational activities, also trough cross-learning of good ecological practices. The proposed activities explore the life cycle of an aliment from when it is purchased by the consumer until it is disposed of, analysing in which stages the consumer wastes food. The exercises were created to understand how to avoid or reduce food waste in those specific phases. The result of the project is composed of two different books containing the educational cards, one for teachers and families with basic information on exercises and the other one for students containing the exercises. The final objective of the educational cards is to sensitize students and adults around them on the food waste problem.

Keywords: Educational Cards; Food Waste; Education; Experiential methodology; Primary School; Visual Communication.

1. Introduction

Food waste is an alarming problem for both sustainable development and nutrition. Globally, a third of the food available (Buchner et al., 2012; Segrè and Azzurro, 2016; MATTM, n.d.), which amounts to 1.3 billion tons per year (FAO, 2013), is lost or wasted resulting in a series of negative impacts in the environmental, economic and social ethics(Marsden and Morley, 2014; BCFN, 2015). The research shows that in Italy 6.6 million tons (Segrè and Falasconi, 2011) are due to the wrong behaviour of the final consumer for the lack of knowledge about food and nutrition (WW, 2013; COOP, 2016).

To educate people on these issues we decided to design educational cards for primary schools (Bellantone, 2018; FMPS, n.d.) that would develop a new behavioural paradigm on aliment in the new generations (GU, 2016; Tringali, 2018). The project is designed as an educational path for the environmental and food education to use at school and at home that include seven educational cards contained in two different books.

In the design process of the books the support of two experts in the field of child education were fundamental: by a teacher from the primary school of Bollengo (Ivrea, Italy) and by a head of the Education Office of Slow Food Italia in Bra. The collaboration with these educators has allowed the designer to integrate some necessary information into the didactic project and to be able to validate the activities designed to be included in the pupils' study plan (MIUR, 2012, 2016).

In order to respect the pupils' study plans, the educational cards have been designed to develop simultaneously both ecological pratices and school subjects. In fact, in the activities there are a series of exercises on waste food in relation to school subjects, for example: for mathematics, exercises with numbers, units of measure and equivalences; for Italian, activities with new terminologies and synthesis skills are learned; in science, exercises to learn components and life cycle of an aliment. Furthermore, great importance is given to solicit of the capacity of collaboration amoung classmates, of communication skills and hypothesis formulation.

2. Concept

The main objectives that the project aims to achieve are awareness of the issues of waste and the topics linked to it: in learning the values and characteristics of food, highlighting how waste can return to a resource, in the development of sustainable behaviours to adopted in everyday life and in the awareness of the importance of personal and collective actions to reduce food waste (Macioce, 2018).

The educational cards are focused on the life cycle of an aliment from when it comes into contact with the final consumer to it being disposed of. We divided these phases in the seven

main stages: knowledge, purchase, storage, processing, waste, reuse and disposal (Figure 1). The decision to analyse these phase of the food is to underline the importance of personal actions and choice during each stage to better understand to what is due to the creation of the food waste and what we can do to avoid it (EXPO, 2015). The principal aliment on which the educational cards are based is the tomato because its easy availability and to the simplicity with which the food waste can be treated.
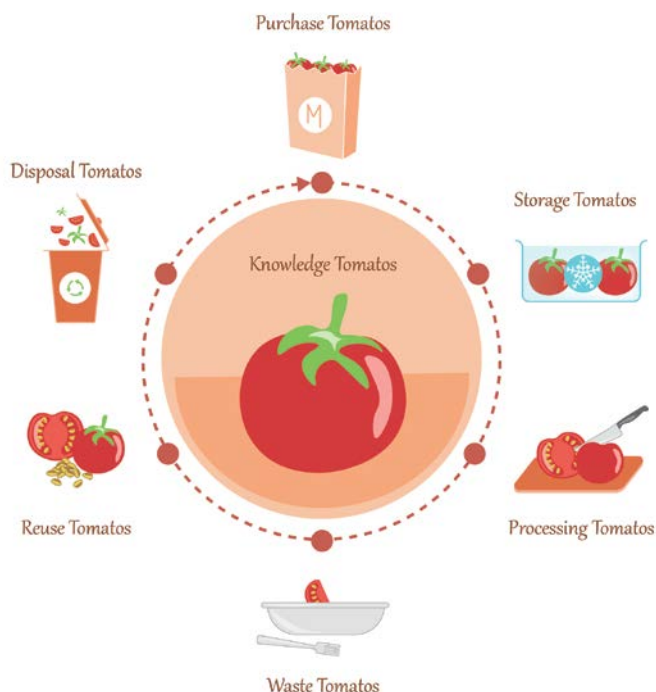

Figure 1. The seven stages of the life cycle of the tomato corresponding to the seven exercises

The target who the project is focused on are primary school pupils, particularly children aged 8 to 10, who attend 3rd-4th-5th grade. It was decided to focus on this age group for different reasons related to the children and their skills: they are independent in using kitchen or gardening tools, they have more ability to formulate hypotheses and solutions, and have competences of language and synthesis (Comino and Macioce, 2019).

All tools developed to educate students to be included in the teaching plans, must follow a series of guidelines and must comply with a series of new methodologies focused on the development of skills, including transversal and soft skills (Calvani and Menichetti, 2015). One of these methods used to develop our educational cards is based on centrality: involving the student in an experiential way to the training activity; making him feel an active part of the educational action; supporting him with the information on the topic and giving him a

good example; stimulating him in the achievement of the objectives and in the formulation of innovative solutions; allowing it to acquire greater awareness on the issue. During the activities the supervision of the educators is fundamental, which allowed to be able to design the didactic cards in compliance with the educational methodologies and the necessary precautions.

To create the educational cards is another fundamental factor were the illustrative and graphic skills of the designer. Visual communication is fundamental for education, it represents a support for education, stimulating learning and mnemonic processes and having a highly inclusive reading, it also allows children with special needs to learn more easily (Paivio, 2006; Menichetti and Sarro, 2015; Calvani, 2011).

3. Results: the educational cards structure

The designed cards are grouped into two books, one for teachers and families, and another for pupils, and they are communicate with each other. The first is a sort of booklet of instructions useful for teachers and families to support the pupils during the exercises, inside all the information essential to carry out the activities can be found. This book, contains fundamental information to allow the activity to be inserted correctly within the pupils' study plan.

The second book is for pupils, it contains the exercises to be performed. All the exercises are divided into different phases, with a first part that illustrates the negative impacts of food waste, the reasons why the exercises are going to be performed and how to reduce or eliminate that negative impact.

Analysing one of this educational cards it's possible to better understand the composition of the activities, the contents and the goals. The educational card "*Waste Tomatos*" is about one of the moments of greatest food waste that takes place inside houses and school canteens: the leftovers. The focus of this exercise is mainly to get aware on the problem of the leftovers and of the negative impact that creates.

To allow to pupils to understand the real problem, in the first part (Figure 2.) of the educational card provides information on the quantities and types of aliments that people mainly wastes in Italy. The second part (Figure 3.) of the exercise is based on collaboration between classmates: they have to weigh all the leftovers occurred in the canteen during the meal. In this way, pupils understand how much food it was waste.Through these activities the pupils perceives the importance of the personal and collective actions that must be taken in order to reduce the food waste.

At this stage, it would be necessary for the teacher to coordinate the activity and collect feedback on the progress of the exercise: creating a moment of sharing with the pupils to

discuss on the results obtained, to talk about the activities and to find solutions to reduce the leftovers during the meal (Figure 4.).
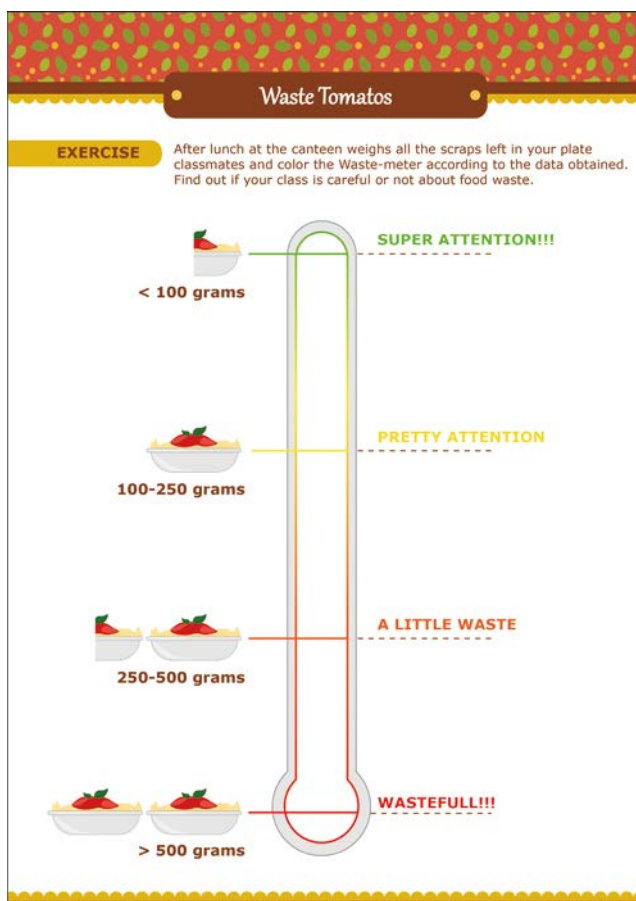

Figure 2. Exaple of the first part of the educational card "Waste Tomatos"

4. Conclusion: future developments

The educational cards are ready for experimentation in primary schools and we are currently looking for funding to print copies of the books and to distribute to local schools interested in the initiative.

The experimentation should start from the beginning of spring until the end of summer, respecting the seasonality of the food on which the exercises are focused. The objective of

the experimentation is to collect as many feedbacks as possible from teachers and families so as to be able to understand if the project has achieved the intended objectives and implement the project. The experimentation will be monitored by verifying the results of the educational forms and by analyzing the data obtained from the questionnaires that will be submitted to the teachers.

Figure 3. Example of the second part of the educational card "Waste Tomatos"

Through these educational cards we hope to sensitize children on the food waste problems, to raise awareness of the adults around the pupils that are called to participate actively in the proposed activities. The strong synergy between the student and the family is necessary for the success of the project and to positively influence adults in their daily actions, to which they are required to learn, share, formulate hypotheses and experiment with the student.

Waste Tomatos

Educational field and contents
Mathematics (numbers; relationships, data and forecasts); Science.

Recipients
Students from 8 to 10 years.

Objectives
Mathematics (numbers): perform the four operations; Mathematics (relations, data and forecasts): measuring quantities (weights) using both arbitrary units and conventional units and instruments (balance); Read and represent relationships and data with diagrams, diagrams and tables. Sciences: taking on ecologically sustainable behavior and personal choices; enhancement of reuse

Preparation and planning
Copy the "We Do Not Sprinkle Tomatoes" activity sheet (one for each student). Get a kitchen scale to weigh advanced foods.

Recommended period to perform the exercise:
The first part of the exercise can be done at home during the summer. The second part, however, at school at any time during the school year.

Place of performance
First phase: at home (Not present in the paper)
Second phase: at school

Difficulty:

1 EXERCISE DESCRIPTION

COMPILATION FORM:
To perform the exercise the child must add the weights of the scraps of his entire class after a meal. Depending on the result obtained, the child colors the sprecometer according to the indications provided.

DATA ANALYSIS:
Students meet as a group and through a moment of sharing they discuss the data collected and try to devise ways to avoid these wastes in the future.

Figure 4. Example of the educational card for teachers and families "Waste Tomatos".

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Deep Teaching: Materials for Teaching Machine and Deep Learning

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Abstract

Machine learning (ML) is considered to be hard because it is relatively complicated in comparison to other topics of computer science. The reason is that machine learning is based heavily on mathematics and abstract concepts. This results in an entry barrier for students: Most students want to avoid such difficult topics in elective courses or self-study.

In the project Deep.Teaching we address these issues: We motivate by selected applications and support courses as well as self-study by giving practical exercises for different topics in machine learning. The teaching material, provided as jupyter notebooks, consists of theoretical and programming sections.

For didactical reasons, we designed programming exercises such that the students have to deeply understand the concepts and principles before they can start to implement a solution. We provide all necessary boilerplate code such that the students can primarily focus on the educational objectives of the exercises. We used different ways to give feedback for self-study: obscured solutions for mathematical results, software tests with assert statements, and graphical illustrations of sample solutions. All of the material is published under a permissive license. Developing jupyter notebooks collaboratively for educational purposes poses some problems. We address these issues and provide solutions/best practices.

Keywords: Machine learning; education; jupyter notebook; programming exercise; collaborative development.

1. Introduction

Machine learning for students of computer science is relatively hard. It requires a strong background in mathematics even more than other areas of computer science. The students have to learn a lot of theoretical concepts and principles before they can deeply understand a specific algorithm or an application based on such.

To our experience, students avoid courses and self-study of difficult topics because they are discouraged by the reasons given above. Machine learning courses are typically not obligatory. However, their necessity is not doubtable. In the last couple of years machine learning algorithms, especially artificial neural networks, improved the results in some fundamental problems of computer science, e.g., image classification (He, 2016), speech recognition (Oord, 2016) or natural language processing (Bahdanau, 2014). Therefore ways have to be found to motivate students for machine learning.

In the project Deep.Teaching we describe three applications which are heavily based on machine learning. For each application, we also give competitions in which the students can participate in teams. Based on our experience, working on such projects increases the initial motivation and reduces difficulties in understanding theoretical concepts. It also deepens the students' knowledge substantially.

Typically a computer science course at our university consists of two elements: lectures and lab sessions. For most machine learning lectures we found good books, tutorials, and other teaching materials mainly focusing on the theory. However, for the lab sessions, there is a need for structured and semantically related exercises. Such exercises should address the relevant topics taught in the lectures respectively *flipped classroom* (Bergmann et al. 2012). In the project Deep.Teaching we developed various such exercises based on jupyter notebooks (https://jupyter.org/) to accommodate the needs. The notebooks are focusing on particular topics of machine learning, and we published all materials under a permissive license on the project website (https://deep-teaching.org).

Unfortunately, these notebooks also have disadvantages if a version control system is used for collaborative development. Jupyter notebooks store many metadata not immediately visible to the user but to the version control system. This property leads to unnecessary merge conflicts and makes development inconvenient.

Another challenge is to give the students the possibility to compare their exercise solution to a sample solution. Usually, all content is visible inside a notebook, so any provided solution would be visible as well. Therefore it is necessary to find a way to obfuscate or disguise the correct answer. This paper explains technics we used to handle that obstacle and describes best practice for collaborative work and sharing jupyter notebooks as teaching materials.

2. Related Work

Different authors described how they used jupyter notebooks for teaching and elementary procedures for working with notebooks in an educational context, see e.g., O'Hara et al. (2015) or Granado et al. (2018).

Lately, some authors and publishing companies also released books online, freely available as interactive *jupyter* notebooks, in addition to the printed version. Examples are the Python Data Science Handbook (VanderPlas, 2016) or Bayesian Methods for Hackers (Davidson-Pilon, 2015).

The project *nbgrader* (https://nbgrader.readthedocs.io/en/stable/) addresses the issue workflow, i.e., how to maintain separate instructor/student versions of a notebook. Its focus lies on how to (automatically) grade the students' solutions and seems to work best in combination with *jupyter* hub, a thin client/server solution, e.g., for classrooms or research labs (https://jupyter.org/hub).

3. Application Scenarios and Jupyter Notebook Exercises

3.1. Application Scenarios

An application scenario should transfer theoretical knowledge in a practical setting. An exciting environment of the scenario is highly essential. In order for the scenario to generate a strong motivation among students, the scenario should, e.g., open a professional perspective or be socially relevant. Functional requirements of teaching are also part of a good scenario choice. So it must be possible to depict the content of the course in the practical setting. Ideally, during the course, small exercises build a solution to a complex problem in the domain. Our scenarios are:

Medical Image Classification focuses primarily on detecting tumors in digitized histopathological images. Main teaching content is the knowledge of convolutional neural networks but also contains portions of fundamental machine learning algorithms.

Robotic Autonomous Driving deals with content required to control a robotic vehicle. Due to the variety of problems, different machine learning paradigms and algorithms are applied in this context. To further motivate students, we developed a framework to control a racecar in a simulated environment and real world (https://gitlab.com/NeuroRace).

Text Information Extraction/Natural Language Processing is a scenario used by many on a daily base, e.g., chatbots or search engines. We use this scenario to provide examples for sequence learning and corresponding algorithms.

A more detailed description of the scenarios is available online on the project website. With the selected scenarios, we cover a wide range of different problem areas and algorithms for machine learning.

In courses at our university and at summer schools the students work on the application scenarios and similar competitions. By working on software solutions. they feel the need to concern themselves with the necessary machine learning fundamentals. The positive feedback from students confirmed us that such scenarios are very motivating.

3.2. Jupyter Notebook Exercises

As a tool for the exercises, we use *jupyter* notebook, which is an interactive environment mainly developed for data science and machine learning (Shen, 2014). *Jupyter* notebooks are documents structured in cells for source code, visualization, mathematical equations, and text.

Jupyter notebook can be used as an environment for both theoretical concepts and exercises. The description of the exercises can be given within the same environment where the students have to implement their solutions. To prepare the students many of our notebooks also contain pen & paper exercises in addition to the programming parts. In most cases, we provide a short review of the necessary theory at the beginning, together with links to literature for further reading. Also within the notebook, code to generate plots and diagrams to visualize the results of the implementation can be predefined. The students can interactively manipulate an input of a code snippet or a mathematical procedure, which results in different behavior of the function and produce another output. Students immediately see results of their changes visually. The effects of such changes become vivid and less abstract.

3.3. Didactic Concepts and Structure of Notebooks

For developing our exercises we use the following (didactic) guidelines. Examples are more illustrative than abstract descriptions. The examples should be as simple as possible that the students can focus on the teaching objective, i.e., we follow the *didactic reduction* principle (Wüest, 2018). We provide all necessary additional helper functions, e.g., for data loading and visualization of the results. This way the students can focus on the learning objectives without the need to implement disturbing *boilerplate code*.

We design the notebooks such that each one supports the learning of one particular subject. This does not exclude that several notebooks chained can lead to the solution of a more complex task. In general, we prefer small notebooks focusing on only one concept. Whenever possible during development of the notebooks we divide larger notebooks in smaller ones. We also tried to avoid strong dependencies between notebooks, which allows

using notebooks in different courses or application scenarios. All notebooks follow the same design and structure. Our blueprint structure is:

Introduction defines the learning objective and describes the structure of the exercise.

Prerequisite provides all necessary information or sources a student needs to solve the exercise. We also provide all required python-modules and data in that section.

Exercise contains instructions for the programming assignments and provides an overview of helper functions used in the exercise. It is also possible to recap certain theory aspects to clarify concepts of the learning objective.

Outlook summarizes the learning content and gives further information to related topics or exercises.

Each notebook ends with a summary of the literature used and a license under which the notebook is published. Besides, each notebook contains a table of content for navigation and optionally an acknowledgment section.

3.4. Feedback and Tests

Our notebooks contain attached images for comparison, e.g., the progress of training a model or the final decision boundary in a classification task. This way students can check visually if their results match with the sample solution images. This also helps teachers when sighting programming assignments. They do not need to stumble through the complete code. If the visualization of a result seems accurate, the corresponding implementation is likely to be correct. Complementary to the visual feedback, we also provide software tests. The tests check if the implementations behave correctly, by comparing their output with the solution. However, the nature of some machine learning tasks is that not all algorithms behave completely deterministic. In these cases, directly testing the output might not be possible, which shows the importance of providing sample solution images of the visualized results.

4. Lessons Learned / Best Practices

This section describes the lessons we learned and the best practices for collaboratively developing and publishing *jupyter* notebooks for educational purposes.

4.1. Workflow for Generating Notebooks

When developing exercise notebooks we create two cells for the solution of a single exercise: A (semi) blank cell, where the students shall implement a function or fill in missing code and a cell containing the sample solution. The student version of the notebooks should not contain the sample solution cells. Manually deleting and maintaining

two different notebooks is error prone and time-consuming. A way to automatically delete the solutions and to generate the student version is needed. For this purpose we utilized the slide type information of the *slideshow feature*, provided by the RISE extension (https://github.com/damianavila/RISE), to mark *solution-cells* as *skip cells*. Moreover, the cells containing the sample solutions can be removed automatically by a script we developed for this use case (also open sourced).

We used two repositories for version control: One for development and one for publishing the notebooks for the students. Openly published notebooks do not contain solutions. Each notebook can be accessed via a web link, so it is easy to reference them from course sites, e.g,. moodle. Teachers can request access to a private repository, which contains the same exercises including the sample solutions.

4.2. Version Control

For the collaborative development of notebooks we used the version control system git (https://git-scm.com). A version control system is typically used for collaborative development and versioning of source code. For collaborative development, one goal was to keep the infrastructure effort as low a possible. So we used *gitlab* (https://gitlab.com/) rather than a self-hosted git infrastructure.

The version control system keeps track of the changes in a text file, which might come from different contributors and in most cases manages to solve conflicts automatically. Jupyter notebooks are stored in JSON-Format (Bray, 2017), which is harder to parse for the control systems (as well as for humans) than plain text.

Another problem is that *jupyter* notebook (the environment) stores meta information together with the notebook content, which results in differences on the text level, e.g., date and time of last execution. This typically results in a merge conflict, which means that the version control system cannot automatically bring the different versions from different contributors together, even if a collaborator has only executed the notebook without modifying anything. To tackle this problem we developed a script which is executed before the updated notebooks are uploaded and removes this unnecessary data to avoid such conflicts.

4.3. Software Requirements

For each notebook we provide a file with software requirements, enabling the user to install the needed packages in a particular version easily. This is crucial as the behavior or naming of external libraries' functions might change in newer versions.

Nevertheless, dependencies to external software libraries should be minimized. Typically modern machine learning libraries underlie frequent API changes, which would either

require to update notebooks permanently to keep them up-to-date or rely on the named file which specifies an older but tested version. However, teaching outdated library usage should be avoided when possible. So we prefer to write notebooks which depend just on fundamental and stable libraries such as numpy (http://numpy.org). Numpy is a basic linear algebra library for working with multi-dimensional arrays similar to Matlab (https://mathworks.com/). That is also in accordance with our teaching goals: The students should learn principles and fundamentals and not special API-calls or software libraries.

For teaching neural networks we are developing minimalistic deep learning libraries from scratch based on numpy only. Corresponding notebooks with exercises show how a modern deep learning library works in principle under the hood. The main functionality of such libraries is automatic gradient calculations (Goodfellow et. al., 2016).

4.4. Numeric Value Tests

The result of many mathematical and programming exercises are numerical values. To provide a software test as direct feedback for the students without spoiling the solution, we use hash functions to obscure the real values. A hash function is a one-way function: it is easy to compute a hash value from the input value, but it is prohibitively expensive to get the input value from the hash value. A typical solution value is a floating point number. So it is essential to take into account that solutions can be given with different numerical precisions. To circumvent that, the solution test rounds the values to the same precision before applying the hash function. An example as code snippet is found in *exercise: evaluation metrics* (https://dev.deep-teaching.org/notebooks/machine-learning-fundamentals/exercise-evaluation-metrics).

5. Discussion and Outlook

This paper aims to present the results of the project Deep.Teaching. Here we discuss possible further developments, improvements, and studies for future work.

We plan to extend and review the notebooks thoroughly in the next year. For this, we would appreciate if we get feedback from teachers of other universities, e.g., by issue tracking (https://gitlab.com/deep.TEACHING/educational-materials/issues).

We want to embed the notebooks in example courses on our website. Each example course should correspond to a web page where the course content is described, and pointers are given to literature for self-study.

At the moment students get just qualitative feedback if they succeeded in solving exercises. If a test fails they know that their solution cannot be entirely correct. For university courses, it would be helpful if the students are graded automatically, i.e., giving them points for

solving exercises. The *nbgrader* project (https://nbgrader.readthedocs.io) addresses this issue. *Nbgrader* requires a special directory structure which does not fit to our current (collaborative) development workflow. However, for teachers, it should be easy to reorganize the notebooks for a course such that they can use *nbgrader* without much effort.

By using *jupyter* notebook exercises in our courses we conclude that *jupyter* notebook is an adequate environment for teaching. We also experienced that abstract concepts can be learned interactively by programming much more clearly and insightful as with mathematical formulas and text alone. We leave it to future work to study this hypothesis quantitatively.

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Interaction of higher and post-university education as a factor of the formation and development of the professionalism of young specialists

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Abstract

The aim of this study is to analyze interaction of university and postgraduate education as a factor in formation and development of qualification of the young specialists. Students of higher educational institutions and young employees aged 18 - 30 years at the industrial enterprises of the Urals serve as the object for empirical analysis. In order to achieve this goal, a set of complementary methods was used: theoretical and empirical (study and generalization of practical experience; questionnaires; qualitative and quantitative analysis of the results), as well as statistical data analysis. The method of secondary processing of the results of sociological stidies conducted with the direct and active participation of the authors was also used. The article presents the results of modern students' monitoring analysis displaying the issues of primary professional development, as well as the survey of young employees at the modern industrial enterprises, reflecting the problems of their professional advancement and prospects for professional and career growth. The conclusion is made about the need for interaction between higher and postgraduate education not only to ensure formation and development of professionalism of the young employees, but also the economic sustainability of enterprises.

Keywords: university education; postgraduate education; students; young specialist; professional development.

1. Introduction

Dramatic changes of the social situation in Russia place serious demands on the qualification level of specialists in any field of production, development and implementation of their potential. Modern enterprises are impelled not only to adapt to the new economic conditions of business, but also to function within the framework of a rapidly changing external environment and intense competition. In order to increase the competitiveness of the manufacturing units and their innovative restructuring, highly skilled personnel capable of performing these tasks are needed. Moreover, young people represent labour, innovative and strategic resource, in which nowadays it is necessary to invest efforts and funds, thus ensuring the success of the future and the economic sustainability of society. Since the 90s of the last century, the maximum strengthening of the youth role in formation of society has become the most widely declared goal of youth policy. The guiding principles of sectoral youth policy are formulated in the European Charter, among which are the promotion of youth employment, preventive measures in the social environment (White paper, 2001). The Bologna process has caused great changes in the field of education in European countries. The modern time is characterized with leading countries' transition to a new stage of innovative society formation - building an economy based primarily on generation, distribution and application of knowledge (Pakhomov *et al.*, 2009, p. 2). "According to experts, the main focus will be on the competencies and skills of future graduates, their suitability for employment" (Abdikerova, 2015, p. 189) "What kind of specialist is expected at a modern industrial enterprise?". Is it a harmonious person whose interests are beyond the scope of his/her work, who is proactive and creative. Or is it, on the contrary, an obedient "knowing his place" specialist - worker. This leads us to the question: "What kind of specialist shall be trained - a single-discipline master in a particular field or a multi-discipline specialist trained in at least the related industries?". These questions reflect the main issue of higher education and the need of its modernization. Among the problems and related tasks during the modernization of the Russian education we can mention the creation of advanced and continuous educational systems ensuring compliance of education with the needs of the economy. Growing importance of professional training for the companies and significant expansion of the need for it over the past thirty years have caused the leading companies to renew their staff's qualification in collaboration with higher educational institutions on the basis of social partnership principles. Organization of professional training has become one of the main functions of personnel management and components of the staff development system. Personnel development is a set of organizational and economic measures of the company's human resources department in the field of personnel training, its retraining and advanced professional training. These measures include issues of professional adaptation, evaluation of candidates for the vacant positions, current periodic personnel evaluation, business

career planning and professional career promotion, work with the personnel reserve, organization of inventive and rationalization work in the company. This undoubtedly applies to all the categories of personnel but to a greater extent to young employees aged 30-35 years who are at the stage of their professional formation and development. The basic elements of personnel professional development system in the company are induction and adaptation; learning motivation; training; management of business career and professional promotion; formation of personnel reserve; development of creative potential of employees. Successful implementation of these activities is possible through interaction of university education and postgraduate education.

The debatable nature of the formulation and study of the above problems indicates their relevance in modern conditions. Note the studies of those scientists who had a direct impact on the organization and conduct of our research. G.O. Abdikerova analyzed the methodology and methods of integration processes of universities with employers (Abdikerova, 2015). Research of S.I. Pakhomov, N.I. Arister, N.U. Venkovsky and V.A. Gurtov is devoted to the state, problems and trends in the development of postgraduate education (Pakhomov et all, 2009). I.V. Teslenko, Y.R. Vishnevsky, with our participation, analyzed the youth in the system of general and vocational education (Vishnevsky, 2016b, pp. 63-116). The study of the economic situation, youth employment and strategies of behavior in the labor sphere was conducted by O.B. Franz, A.N. Popov, A.G. Mokronosov, P.L.Gluhih and A.A. Vershinin (Vishnevsky, 2016b, pp. 117-161).

The aim of our study is to attempt to show that the interaction of university and postgraduate education is a factor of professional formation and development of a young specialist. We proceed from the rationale that formation and development of young specialist qualification is possible when creating a system of continuous and advanced education thought interaction of university and postgraduate education. Nowadays it is the ideology of continuous education that conceptually determines the educational policy in the world (Life Long Learning.., 2014, p. 2).

2. Methodology and research results

The methodological basis of this study consists of such basic approaches of studing the youth policy as: normative-value, systemic, structural-functional, sociological and psychological. In order to achieve this goal a set of complementary methods was used: theoretical (analysis of philosophical, managerial, sociological, and pedagogical literature on the problem; systematic fact analysis; generalization; classification; mental experiment; modeling) and empirical (study and generalization of practical experience; questionnaire; qualitative and quantitative analysis of results), as well as statistical data analysis. The

method of secondary processing of the sociological study results conducted with our direct and active participation was also used.

Since the professional development and advancement of young employees are influenced by a behavioral model formed mainly by an educational institution, we analyzed the results of monitoring "STUDENT 1995–2016. Dynamics of social and cultural development of students of the Middle Urals" (Vishnevsky *et al.*, 2017) (the sample was from 851 people in 1995 to 1827 people in 2016), which made it possible to determine changes in the main characteristics of student community (social status and state, adaptation processes, education and professional development, value orientations and extracurricular activities), as well as students' ideas about future work.

Within the framework of monitoring the social and cultural portrait of student community of universities in Sverdlovsk region, the processes of primary professionalization of future specialists were analyzed in three main areas: motives of the primary motivation for choosing a university; significance of the future profession (system of professional values); professional plans of the third-year students.

The results of the students' survey showed that among the motives for choosing a university from 2007 to the present, the 1st place belongs to interest in the profession, the 2nd place is prestige, reputation of the university, and the 3rd place refers to the prospect of finding a good job (Vishnevsky *et al.*, 2017, p. 352). The dynamics of the system of professional values has been recorded: possibility of high earnings is consistently prioritized; career opportunities and achieving high qualification are equally stable. Students attached much less importance to autonomy, independence, lack of petty care, regulation; compliance of the profession with the abilities, knowledge and skills of a person; underestimation of connection between the profession and modern equipment, latest technologies became stronger (Vishnevsky *et al.*, 2017, p. 367). Students' plans for job are as follows: practical work in the private sector was noted by 57.8%, practical work in the public sector (teacher, doctor) - 17.1%, public officers - 15.1%, work in the scientific field - 10.0% (Vishnevsky *et al.*, 2017, p. 383).

Analysis of the subjective perception of the situation on the labor market by future specialists preparing for transition from the education system to the employment system has been carried out. The problems faced by the young people after completion of education subsequently affect the situation on the labor market reducing the amount of wages, and acting as a signal to the employer about lower productivity and competitiveness. In the students' opinion, the rating of such problems is as follows: absence of work experience, practical experience (75%), low salary level (48%), lack of open vacancies (43%). Students see combining study and work as one of the solutions to these problems, and the most

efficient students consider continuing work with the same employer where they had work placement or worked during their studies (2009 - 30%, 2012 - 33%, 2016 - 53%).

Transition from study to work is an important stage in a person's life. In order to evaluate satisfaction of the young employees with the main aspects of their activities at enterprises, including the advanced training system and the prospects for professional and career growth, we analyzed the results of a survey in 2016 of 1,000 young employees from 22 enterprises located in 12 cities in the Urals. Within the same analysis we examined the statistical indicators of efficiency for the corporate youth programs implementation: improvement of qualification level, career growth, and creative action of young employees in their professional, scientific and technical activities.

According to the statistics provided by factory human resources departments, under our application, in 2014 the turnover rate among young employees at enterprises comprised 16% (in 2012 and 2013, respectively, 8% and 15%), improvement of qualification level was 28% (in 2012 and 2013, respectively, 41% and 27%), creative action of young employees in professional, scientific and technical activities - 12% (in 2012 without changes, in 2013 - 20%). (Vishnevsky, 2016a, p. 344). The results of a survey of young employees provided the key to understanding the reasons for such dynamics. All the categories of respondents named "Guaranteed stable work", "Earning decent wages" and opportunity to make a career (respectively, 76.2%, 69.8% and 35.9%) among the motivators of activities at the enterprise occupying the first three places. Opportunity of advanced training is a motivator for choosing an enterprise for every fifth young specialist (21.2%). Level of satisfaction with the opportunity to raise qualifications is relatively high (satisfaction ratio is 0.69) (Vishnevsky, 2016b, p. 235). Employees with secondary professional education highly appreciate the prospects in this regard, noting that there is an opportunity to conclude a tripartite "university – enterprise – employee" agreement for receiving professional education. In our opinion, the desire for advanced training and the level of satisfaction with aspects of labor indicate a universal cognitive creative ability based on the interaction of intelligence, cognitive abilities and real achievements of youth.

3. Conclusion

Youth programs implementation analysis at large industrial enterprises indicates the existence of continuous educational systems ensuring not only the development of the enterprise, but also "the continuous development of the professional corresponding to the evolving modern production" (Vishnevsky, 2016b, p. 251) [5, p. 251]. Today they have already started talking about the "ahead of time education". The main task of ahead of time education is to focus not only on the production developing at this stage, but also on the

expected future. In this regard, it is important to improve a social partnership "enterprise - university (college) - young employee" for development of young specialists.

A new trend has been revealed for corporations and large enterprises of Russia when creating a system of continuous and ahead of time development consisting in creation of corporate universities whose activities are referred to as in-house training. Simultaneously, corporate universities have some characteristics of a university: they allow people to constantly improve their professional level through training, internships, on the one hand. Corporate University is not an alternative to a higher or secondary professional education. "It is an efficient tool for generation of a single information environment for company employees, as well as a center of scientific knowledge" (TMK group, 2019) [7].

The conducted study gives reason to believe that interaction of higher and postgraduate education is a factor in professional formation and development of a young specialist, as evidenced by the tasks solved at the various stages of this development. It is the university that forms in a young person the need of "lifelong" education. Enterprises implementing the system of in-house development, including continuous and ahead of time education at interaction of higher education and postgraduate education, ensure their economic strength by fully promoting improvement and development of qualification of the young specialists.

This study allowed us to develop and test an integrated approach to the analysis of the professional formation and development of young specialists during their studies at an educational institution and acquisition of their professional skills. And at an industrial level, it allowed to identify problems in the interaction of higher and postgraduate education, to develop proposals and recommendations for improving the system of formation and development of young workers' professionalism.

 The results of the study can be used for developing of extanded and advanced education programs, implemented by universities in conjunction with industrial enterprises, as well as clarifying issues related to the implementation of youth programs in industrial enterprises, including personnel development programs.

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Teaching and Learning in Statistics: Harnessing the power of modern statistical software to improve students statistical reasoning and thinking

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Abstract

The reproducibility crisis in science has launched global discussion about the need to restructure the way statistics is taught across a wide range of disciplines. While this need has been recognized and discussed in the academic community for many years, the impetus for educational reform of statistics was boosted by Ioannidis (2005), which resulted in a great deal of attention on issues regarding the inappropriate use of statistical reasoning.

The availability of data across business and research has increased dramatically in recent years. This access to data has resulted in almost every member of society needing a skill set that allows them to think critically about the inferences that can validly be drawn to improve decisions based on data.

One way of improving statistical literacy and thinking is through the identification and use of appropriate statistical software that will allow students, and other practitioners with basic training, access to modern statistical modeling techniques on a platform that allows them to focus on outcomes. A key component of using AutoStat for teaching statistical thinking is in alleviating the need for coding, which allows the instructors to focus on key concepts, questions and outcomes.

Keywords: statistical education; data literacy; statistical software; AutoStat; student engagement.

1. Introduction

Ioannidis (2005), brought to the fore a long debated issue in research, which is now commonly referred to as the "replication crisis in science", which has inspired a number of subsequent publications (Fraser & Reid, Gelmen & Loken 2014) emphasizing the role that statistics, and in particular, statistical education, has played in the current dilemma.

Since the publication of this pivotal paper (Ioannidis, 2005), an outpouring of passionate views in terms of statistical education across many disciplines has seemingly culminated in a concerted effort to modernize statistical training, often termed "statistics education". This sentiment is not new, for example, George Cobb has long championed the need to reform the teaching of statistics (Cobb, 1992, 1993), and many professional meetings during the 1990's, such as the 1992 Committee on Applied and Theoretical Statistics (CATS) workshop on "Modern Interdisciplinary University Statistics Education" noted that the content of many undergraduate courses lagged behind the current recommended best practices in statistics at a concerning level. It seems, however, little change in introductory courses has taken place, with Cobb (2015) arguing that the undergraduate curriculum in statistics now needs a complete overhaul.

The demographics of students requiring statistical training has become extremely diverse. It is now generally accepted that the collection of data in modern society is so abundant, that almost everyone requires a solid grounding in statistical thinking. As noted in Deng (2015), however, the ability of people to understand data has been far outstripped by their ability to access data. It is from this position that many courses in data science, introductory statistics and other research fields that have a lower level of contribution from quantitative analysis, may benefit from exposing students to statistical concepts through the use of software designed with this purpose in mind.

Further to this, statistics education in the modern era needs to be shifted from the traditional math and science subjects and evolve into a subject that is accessible to students training in a wide variety of disciplines (Zieffler et al. 2018). The needs of students in various fields differ, but it is a general consensus that modern statistical education should provide statistical literacy, statistical reasoning and statistical thinking as a basis for a positive learning outcome (Steel et al. 2019). Cobb (2015) reiterates the approach proposed by Brown and Kass (2009), calling for undergraduate courses in statistics that make the fundamental concepts of statistical thinking accessible to a wide range of students, in various disciplines, and to minimize the mathematical prerequisites for general courses. One way to achieve this outcome is by using computing to explain and discuss concepts and inferences that can be drawn from data analysis.

2. Teaching statistics using modeling

While there has been a great deal of angst towards Null Hypothesis Significance Testing (NHST) and it's contribution to the current reproducibility crisis (ASA statement 2016), perhaps the simplest way forward is to introduce a teaching culture that by-passes the use of p<0.05 and the testing mentality that is so often used in introductory statistics courses. As noted by Rodgers (2010), practicing statisticians moved from NHST towards modeling with the availability of computers becoming commonplace. Indeed, statisticians themselves no longer view the practice of statistics as applying a set of mechanical procedures and conducting decisions in regards to p<0.05, but rather as a process of building models and assessing their merit. If introductory statistical courses allowed students to start in the modeling space, we believe that the learning outcomes would be enhanced, and the tendency to make their own research data fit into a set of narrowly focused procedures would dissipate.

The importance of modeling and its natural role in assisting students to develop the skills of statistical reasoning is also noted in the call for papers for The Eleventh International Research Forum on Statistical Reasoning, Thinking, and Literacy. This overarching statement for the meeting makes clear that this groups perception is that by allowing students to focus on the process of modeling, rather than the actual model itself, it will encourage them to rethink the role of statistics which will encourages a better understanding of data and chance.

Moving forward, from a teaching perspective, replacing the standard NHST based curriculum with a model based approach, will see its success hinge on choosing an appropriate software platform. To obtain learning outcomes that improve students statistical thinking, choosing the correct software will allow students to focus more on the variety of outputs of the model and data analysis, thus facilitating greater investment in the problem solving, reasoning and decision making aspects of statistics.

3. The Choice of AutoStat in Teaching

Statistical Rethinking (McElreath, 2016) is an example of a modern statistical course that places an emphasis on statistical models, using computers and coding to understand the models and algorithms, rather than a strictly mathematical approach. While McElreath (2016) uses R and Stan, which he argues increases students statistical thinking by the implementation of the models via command line coding, others, such as Peng (2015) argue the need for statistical software that can assist researchers who will only receive basic training in statistics to produce robust, reproducible research outcomes.

While R and similar scripting based software can aid statistical learning for some students, they are frequently studying STEM streams. In particular, for students of statistics, coding is an excellent means of understanding the algorithm behind the model. However, notwithstanding the great advances in operability of these platforms, many students – and researchers - do not have the interest, time, skills, repeated exposure or inclination to overcome the learning step to fully access the power and utility of the packages and keep abreast of updates. This can result in students and researchers feeling excluded or frustrated, withdrawing their initial interest in statistics and even becoming resistant to the topic. Moreover, even if they overcome these challenges, they can still be confronted by the task of ensuring that their adopted methods are appropriate and reproducible.

AutoStat is a new statistical software package that embeds state-of-the-art statistical and machine learning tools in an accessible, modeling-focused interface. It is designed to meet the needs of researchers and students who would otherwise be excluded from the process of modern statistical modeling due to their lack of coding acumen or through an academic inclination that does not encompass coding. It also addresses the need for appropriate, reproducible statistical approaches by removing many of the error-prone steps associated with coding, choice of algorithm and presentation of results. The look and feel of AutoStat, combined with the addition of both short and long tutorials, specialized modules for common analyses and auto predict options, is designed to facilitate confidence in modeling and further exploration of statistical paradigms and potential.

Many traditionally non-mathematical fields of study are increasingly requiring statistical studies to be incorporated in their course syllabus. However, as these topics are likely to be a minor inclusion in the overall scheme of the degree, it is essential that these students will be taught statistical thinking and concepts, rather then the mechanics of computing. For example, in the field of Social Sciences, leading academics (Jackman 2009, Kaplan 2014, van de Schoot et al. 2013) have recently presented strong arguments for the practicality of using Bayesian analysis for modeling and answering many research questions in this field. However, access to Bayesian statistical methods for both teaching and research in Social Sciences is restricted by the availability of suitable software for this audience. Similarly, modern statistical machine learning methods are essential for modern data analysts and researchers in the 'big data' era, but are often inaccessible in standard software. Rather than treating Bayesian and Frequentist paradigms as disparate entities or statistics and machine learning as separate disciplines, AutoStat switches seamlessly between them. This enables students and researchers to better understand the similarities and differences between the various approaches and underlying philosophies, and allows instructors to teach concepts and thinking, as opposed to coding.

3.1. The advantage of the logical flow of AutoStat

A key feature of AutoStat for teaching is the logical flow provided in the user interface. The sequence provided in AutoStat begins with the Project Menu (Figure 1), where students will be able to organize their projects, and collaborate through the share facility when doing group work. The Task Menu (Figure 2) then provides a clear set of procedures available within the software, namely data management, visualization, model building, result summaries and report builders.
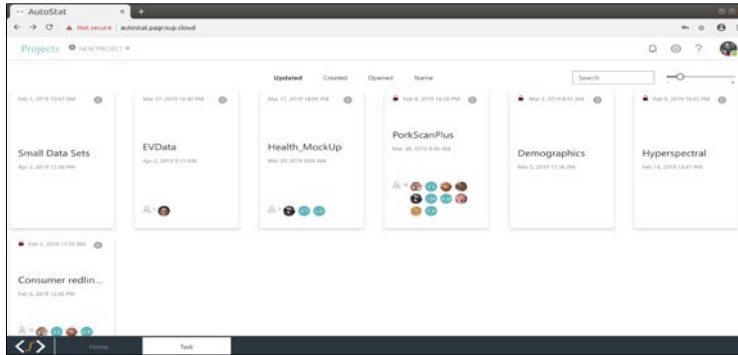

Figure 1 .The Project Menu shows all current projects and members. Project sharing is allocated by the project owner, who may elect to share a copy and nominate sharing permissions. The account administrator can restrict access to non-required modeling or other modules to prevent account overuse.
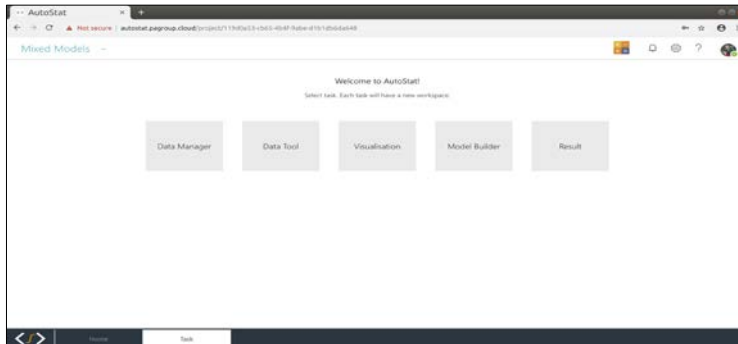

Figure 2. The Task Menuallows students to understand the logical flow from data management through to visualization as a exploratory data analysis tool, then through to modeling and interpretation of results. NHST is available within the Data Tool, a placement which emphasizes its role more along the lines of exploratory analysis and encourages further exploration via modeling.

The inbuilt data management facilities allow users to import their data and perform all necessary adjustments, such as factorization and filtering by the use of a drop down menu. The flow of the Task Menu is deliberate, in that the left to right setting of the options

implies the logical flow of statistical analysis, namely the following 5 steps (where steps 3 and 4 are an iterative process):

1. Data management
2. Visualization
3. Statistical modeling
4. Examination of results
5. Reporting outcomes

These steps are conducted quite easily by the student using drop down or drag and drop features in the GUI (See Figures 3 & 4). This style of GUI allows the student to perform their statistical analysis in the familiar drag and drop with either a mouse, or more casually on touch screens, such as an IPad or tablet device.
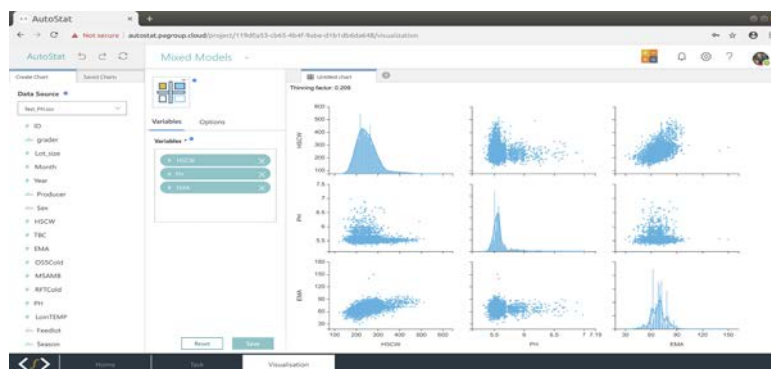

Figure 3. Visualizations are available using drag and drop via a mouse or touchscreen

An advantage of touchscreen drag and drop while teaching concepts is the ease with which the model is constructed. In this way, very little intellectual resources are diverted towards "making the computer work", and this allows the instructor to "invite your students to stay with the question" (Stangl, 2017).

Importantly, AutoStat has been devised to aid in the reproducibility of research (or model based decisions) for students well into their future careers, whether they be research based, or industry related. The logical flow of work, accessible data management and queries, ready access to stored results from all models in the history of the project and inbuilt report editor are helpful to people with only basic training, tending to assist in the pipeline of logical thinking of data outcomes. AutoStat incorporates modern algorithms, which are intended to be kept up to date with statistical developments, with older techniques being phased out of the model builder when appropriate, yet remaining available to re-run past analyses when required.
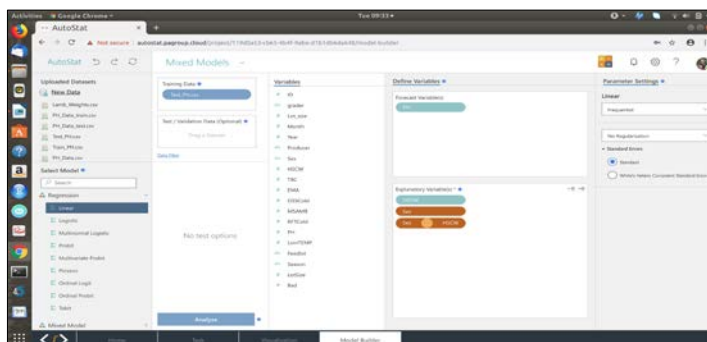
Figure 4: Modeling is performed using drag and drop options

4. Discussion

The current debate around research reproducibility has highlighted the need for new and novel approaches to increasing data literacy and statistical thinking among a broad range of students and professions. Indeed, as suggested by Peng (2015), increasing the data literacy and thinking skills across a range of student study streams will assist ease these current issues by improving the quality of research papers, and hence reducing the pressure on the peer review system. The provision of statistical software that is accessible to a range of users is an essential element of overhauling the current educational approach to statistical learning.

AutoStat has the potential to free students' intellectual resources in order to focus on understanding the ideas, concepts and inferences in statistical modeling, and will allow them to apply modern, innovative statistical methods to their own research into the future.

The prevalence of data in modern society has also fueled this need, with a broad range of people requiring an education that allows them to make decisions based on thinking critically in regards to available data sources. While many people attempting to make decisions based on data have the ability, with access to appropriate training, to understand statistical concepts and think in these terms, performing such tasks in the real world will be contingent upon using a software that is appropriate for their frequency of use.

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Ontology rules application for efficient career choice

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Abstract

The aim of this work is to help university applicants in their transition phase from high-school to tertiary education starting with their first life-long decision concerning their choice of the field of study.

The construction of the decision support system has evolved into an ontology-based model. The model, as well as the decision making rules, have been formulated based on the research study of the cohort of 119230 students of the University of Alicante between 2010 and 2018.

The educational and psychological processes have been studied in order to identify the pivot moments and the factors that may lead to an adequate decision making or to an objectively wrong decision which eventually ends up in a drop-out of studies.

Analysing the existing methods of occupational and educational choice assistance, the method of John L. Holland on "A Psychological Classification of Occupations" has been selected as the most viable and convenient for this purpose. The Holland Codes have been adopted as a lingua franca of this ontology-based model.

As a result, the ontology-based decision support system provides assistance in decision making using the Holland Code terminology and practically unlimited complexity of the object and data properties of and ontological presentation of knowledge.

Keywords: ontology-based decision support system; occupational and educational choice; Holland Code.

1. Introduction

Student's natural learning motivation has been an objective of many educational research works. Being properly and timely recognized this motivation makes it possible for a young person to adequately and independently make the best educational choice which will have a life-long effect. The willingness to study, the volume and the quality of the information taken, occupational satisfaction, a life-long success and personal adaptation of each member of the modern society depend on those decisions.

For that purpose, the following assignments have been accomplished: statistical analysis of the first year performance for a cohort of 11923 students of the University of Alicante. We analysed in a longitudinal sample spanning from 2010/11 to 2017/18.

An ontology has been developed in order to rationalize, organize and automate the processes, procedures of the decision support system, based on the rules within the semantic net context notions of the study area in question.

2. Current state of affairs

At the age of 15-16, when opting between existing high-school educational study programmes (Vidal I. M., 2014) young people have to face their first life defining decisions. Having taken one of the educational options the high-school students limit themselves in terms of their future careers (Startseva E.B., 2017).

Spanish high school students specialize in three study programmes (Sanchez, 2014): natural science, social studies, arts and humanitarian studies which are to prepare the high school leavers for enrolment in university also in three different fields of study correspondingly.

The diagram below (Fig. 1) reveals that although the three main high-school study programmes are equally represented between high school leavers, 64% of the university entrants (Fig. 2) prefer social studies and economics rather than anything else, and only 8% seem to seek a humanitarian or languages careers. Moreover, this proportion changes even after the enrolment process is over.
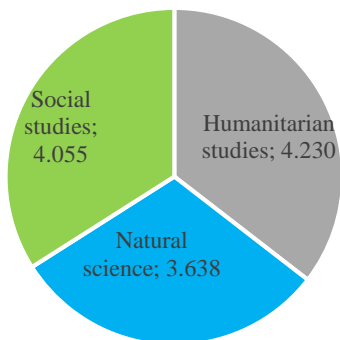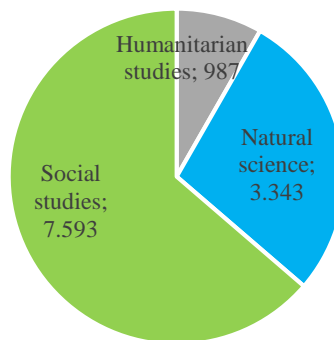
Fig.1. High School study programmes

Fig.2. University fields of study

Similarly, in the US "up to 80 per cent of matriculants enter college undecided on a major and up to 50 per cent change majors at some point during their enrolment" (Ronan, 2005).

While the number of students has been rising, so has the proportion who fail to come back for a second year. In all, more than a million US students a year quit college (Marcus, 2018). High dropout rates and overly extended studies among undergraduate students represent an increasing challenge to the modern society. "In America 40 per cent of college students fail to graduate with four-year degrees within six years of enrolling. Drop-out rates across the developed world average around 30 per cent" (The Economist, 2018). A third of Spanish undergraduate students do not complete their degree in 4 years or simply dropout (Ministerio de Educación, Cultura y Deporte, 2016).

These figures raise a very important question of why many former high-school students eventually transferred to a field of study that was very different from their high-school study programme, quit college or overly extend the time to graduate and whether half of the university entrants are not pleased with their high school choice or they are unsure about their next career oriented step. In other words, they have either made an erroneous choice while studying at high school or are making a mistake choosing a wrong university career, or both.

In 2017/2018, Spanish expenditure on education reached €51.3 billion of which 20 per cent (€10.26 billion) was directly invested in the higher education, and nearly €530 million was awarded for scholarships, increasing expenditure to nearly €11 billion. (Ministerio de Educación y Formación profesional). With a 1/3 of all university entrants eventually finding themselves dissatisfied with their field of study and considering the dropout option, this results in an annual cost of over €3 billion to the public purse. (Vidal M. , 2017)

The number of undecided students varies across institutions and sources but the volume it represents highlights the large impact and importance of understanding and assisting the

undecided (Emily Bullock-Yowell, 2014) as well as those who believe that they have already made their commitment to a major and a potential career.

At the same time being a student is not a solution in itself. Students have little understanding of the skills and degrees that will increase their employability (Bersin, 2013). According to some studies, up to 47 percent of U.S. jobs and over 70 per cent of those in India were rated as highly likely to become computerized in the next 10-20 years. Such qualifications as an accountant will be of little benefit for the individual employee, because – over time – there is a 98 per cent probability that the work of an accountant can be done by intelligent software (Alfons Botthof, 2015), in the worst case scenario it may happen even before the student has passed all ECTS credits.

Hence, research in the area of careers guidance is crucial for all stakeholders especially young people who need to be guided as to the important aspects to consider before choosing their field of study at University. This guidance shall form a part of the "strategic framework for European cooperation in education and training in order to respond to the challenges of the modern world, to better provide the means for all citizens to realize their potentials, as well as ensure sustainable economic prosperity and employability" (European Commission, 2018).

For example, the quantitative analysis of the first year University performance for cohort of more than 11000 university entrants has proved that those with the natural science high school background are better off (82% of the ECTS credits passed) in all university fields of study. While those majored in humanitarian and social studies showed 72,3% and 71,4% of the ECTS credits passed correspondingly (Fig.3).
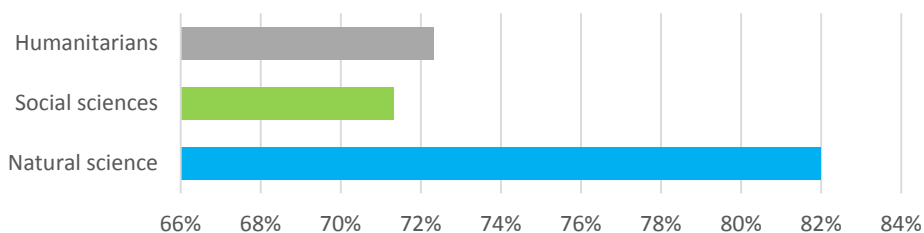
Fig. 3. End of year pass rate of the ECTS credits for each high school study programme

The educational and psychological processes have been studied in order to identify the pivot moments and the factors that may lead to an adequate decision making or to an objectively wrong decision which eventually ends up in a drop-out of studies.

3. Ontology description

The proposed ontology-based decision support system (DSS), apart from the high-school performance factors (which are at the moment the generally accepted key indicators in choosing the field of study), make use of large spectrum of knowledge i.e. expert assessment of labor market perspective, strategic planning requirements, occupational psycology (Holland Occupation Test (Holland Code Career Test, 2017)) that focuses on career and vocational choice by grouping people on the basis of their suitability for different categories of occupations, the Position Classification Inventory (PCI) (Gottfredson, 1991) which enables to use the Self-Directed Search results to locate and explore the degree of match between an applicant and future job, provide a structure for locating future career possibilities, the Multiple Intelligences theory which focuses on strengths or intelligences that can be interpreted as learning styles, information on the applicant's individual characteristics based on the human design classification (Parkyn, 2010) (logical and consistent system which the authors find quite useful to apply in order to prove validity of other theories and methods).

The ontological model DSS has been applied for data and knowledge analysis to provide integrity and consistency and to be used for elaboration of the DSS rules. Those rules shall provide an applicant with an answer as to which major to choose, the study prospective in general using the input of the individual data mentioned before. The authors believe that this information will encourage each student to study the chosen major and also duly inform the applicant about possible riskes implied by the choice taken.
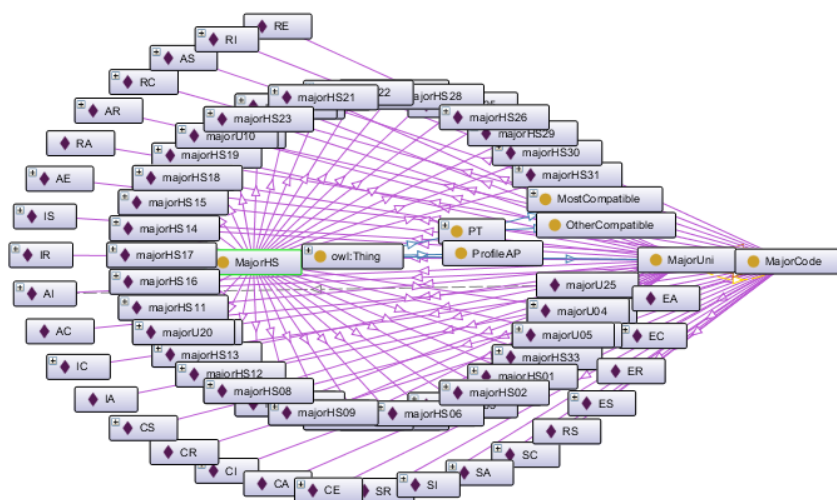

Fig. 4. OntoGraf with the class samples and objects

The contruction phase of the ontology-based DSS is presented in Fig.4. The main characteristic of the proposed system shall be the following: its ability to identify the applicants' architypes: to recognize an educational behavioural pattern and, more importantly, capabilities and inclinations together with the ability to spot the congruent professional areas. Instead of saying that "learning can be characterized as the procedure of obtaining knowledge or aptitudes (Shaimaa Nafea, 2016) we can add that with the help of the ontology-based DSS learning starts with the procedure of self-recognition, use of the natural learning patterns, identification and encouragement of natural professional inclination. The core idea of the system is that every person is individually gifted, it treats the capabilities (competencies) as the possibility for a person to significantly contribute into the social development (Gvozdev V.E., 2014).

The Holland Codes have been adopted as a lingua franca of this ontology-based model. At the initial stage the proposed ontology-based decision support system shall assist its users (high-school student and university applicants) to identify the best choice major and take the correct learning path. This system applies productive rules in order to select an adequate field of study on an individual basis by using semantic rules and rule-based reasoning so as to detect the individually corresponding fields of study. Eventually this ontology can be applied together with other ontologies like Learning Domain Ontology and become a part of the Learning Network.

Application of all these criteria has made it possible to formulate the decision making rules for a better choice of a university major.

These rules are formulated in SWRL on the subject area ontology (Fig. 5).

Fig. 5. Examples of SWRL rules

The obtained results of the rules application as well as dynamic monitoring of the main economic and social tendencies make it possible to adjust and update the DSS through introduction of the new rules.

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Developing start-ups with academic support in Romania

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Abstract

The objective of the paper is to present how experts from Spiru Haret University have been involved in the development and implementation of a project aimed at the start-up development in the Central region of Romania, This project runs within one of the first European funded programs where universities are eligible.

The project ran through the first stage of entrepreneurship training by September 2018, where 371 members of the target group (of the 403 selected) completed an entrepreneurial training course, supported by academic staff. Subsequently, a business plan competition was organized in two sessions (in November and December 2018), following which 38 business plans were selected, the ones selected attended training in the same industry they intend to develop their business.

By July 2020, the 38 selected entrepreneurs will benefit from counseling and mentoring services, along with the monitoring of the business plan.

Keywords: entrepreneurship; training; start-up.

1. Introduction

As shown in a literature review on entrepreneurship education and entrepreneurs' skills (Almahry, Sarea & Hamdan, 2018), the development of start-ups has many beneficial effects. Fritsch (2013) describes how start-up development accelerates structural change, Stam (2008) reports on innovation and growth, and Boschma (2008) on regional development. Cumming, Johan & Zhang (2014) stated that 1% increase in new business start-up leads to a 24% improvement in the GDP in the subsequent year, also reduce unemployment by 13% and increase export by 3%. Also, Schmiemann (2008) on a study regarding European Union, shows that the percentage of entrepreneurial enterprises in total of all enterprises are higher than 95% in most of the developed countries, while 60% of all available workforce are employed in those firms.

Supporting the development of small and medium-sized enterprises (SMEs) is a priority at both European Union and national level in Romania because this extremely large category of economic agents, more dynamic and flexible than large companies, is the backbone of any modern economy.

In Romania, 99% of companies are SMEs, which produce 60% of GDP and employ 60% of the workforce. The Romanian economic environment is characterized by pessimism regarding the development of the economic environment (only 13.78% of companies appreciate that the evolution of the Romanian business environment will be favorable to SMEs), difficulties in overcoming bureaucratic problems 61.41% of SMEs consider bureaucracy to be the main problem in business development) and lack of interest in accessing European funded programs (81.66% of entrepreneurs intend not to access structural funds in the next period) - (Government of Romania, 2017, 1).

In this respect, the programs that stimulate entrepreneurship, especially among vulnerable social categories, such as young people, as well as those who have lost their jobs in the European Economic Area and have returned to the country, are of public interest, helping to solve acute social problems.

At the level of the "Centre" region of Romania (comprising the counties: Alba, Braşov, Covasna, Harghita, Mureş and Sibiu) the unemployment rate (in ce an?) was of 6.4% (5.6% at national level) 5.6%), above the national rate, with significant intra-regional disparities: the highest value is registered in Alba County (8.7%), and the lowest in the Sibiu and Brasov counties (4.8% respectively 5.1%) - (Agency for Regional Development Center, 2014, 59). According to the same document, the volume of foreign investments in the Central Region has significantly decreased since 2009 and the economic sector represented by small and medium enterprises suffered a sensitive contraction after 2008.

2. Romania Start-Up Plus Program. Involvement of universities

In 2016, the call for "Romania Start-Up Plus" projects was launched within the Human Capital Program. This call for projects aimed at encouraging entrepreneurship and self-employment by supporting the establishment of non-agricultural enterprises in the urban area.

This is one of the first programs of this type in which universities can get involved; in previous years, start-up funding was allocated to other types of legal entities (consultancy firms, professional associations, NGOs, etc.). There are many articles describing the role of universities in promoting entrepreneurship both at national level (Popescu, 2008) or other European countries, such as Spain (Fernandez-Nogueira et.al., 2018).

This program aimed at financing projects that meet a three-step succession in implementation:

1) Entrepreneurship training in which actions are carried out that ultimately lead to the improvement of the entrepreneurial skills of individuals (eg unemployed, inactive people – including students, people who have a job and set up a business to create new jobs) intending to set up a non-agricultural business in the urban area. At this stage, public information, selection of the target group and the implementation of the entrepreneurial training program (authorized by the National Authority for Qualifications) are carried out. At the end of the training phase are selected the business plans to be funded under the project, and the selected ones will be required to attend practical training sessions.

   At the end of this phase (with a maximum duration of 12 months), each project funded under the Romania Start-Up Plus program was to improve entrepreneurial skills for at least 300 people, of which to select at least 30 business plans, for a grant of up to 40,000 euros.

2) Implementing the business plans (to be funded from the European Social Fund), a stage that lasts for at least 18 months, which includes at least:

   - The provision by the entrepreneur scheme manager of personalized counseling / mentoring services following the completion of the business plan selection process;
   - Ensuring the establishing and start-up of businesses that will carry out business plans within the project;
   - Support of the implementation of selected business plans within the project.

3) A program of monitoring the functioning and development of funded businesses (maximum 6 months). At this stage, the entrepreneur scheme manager conducts actions aiming at monitoring the activity of the established enterprises, including

the exploitation and sustainability of the assumed business idea for the development (and not just the survival in the market), as well as achieving all the results assumed by the project , with particular attention being paid to maintaining the jobs created in the second phase and to the functionality of the businesses created.

The Ministry of European Funds published in January 2018 the final list of funded projects. Out of the 195 projects funded, 20 have as main applicants universities in Romania; the list published does not contain data about partner organizations, including universities. It is a remarkable result, since it is one of the first calls of projects in Romania on the development of start-ups where universities have been able to apply.

3. The "PROFIT" project - the training phase

The PROFIT project (Romanian abbreviation of the title: " PROmotors of your Firm - for the Centre region) has as a general objective the development of entrepreneurial skills and the creation of new business in the Centre region, through the provision of professional training programs and integrated activities. It is implemented in partnership by the Sustainable Development Agency of Brasov County and Spiru Haret University (which is the main private university in Romania).

The project aims to contribute to the promotion of entrepreneurial culture and optimization of the skills of the target group members to realistically identify and apply business ideas in order to generate long-term positive effects.

The implementation period of the PROFIT project is January 15, 2018 - December 31, 2020, the project being currently in the second stage of implementation (see below) the implementation of the business plans. As far as the first step described in the previous paragraph is concerned with entrepreneurship training, it ended in January 2019, with the following key results:

- 5240 people participated in information activities (in person and on-line), organized in the six counties in the Centre region, Romania.
- 403 people (237 women and 166 man) were part of the target group of the project, having the following socio-demographic characteristics:
- The business plan competition was held in two sessions: In November 2018, 51 business plans were filed, of which 32 were selected for funding, and in December 2018 24 business plans were submitted, out of which were selected 6.
- In January 2019, 38 entrepreneurs to be have completed a stage of practice, thus completing the training phase. The internship was conducted in the same industry where they want to develop their business.

Table 1. Target group by age groups

age groups	persons
below 25 years	50
between 25 and 54 old	337
over 54 years old	16

Table 2. Target group by socio-professional status

socio-professional status	persons
employess	242
students	116
inactive (other categories, except for students)	42
registered unemployed	3

Figure 1. PROFIT logo

4. Implementation and monitoring of business plans (2018-2020) with academic support

Spiru Haret University experts will also be involved in the next two stages of the PROFIT project, the implementation of business plans and the monitoring of the functioning and development of funded businesses (see paragraph 2 above)

The academic staff will be involved at this stage in the following activities:

a) Provide counseling / mentoring / mentoring services to selected individuals for the implementation of business plans, thus completing their theoretical knowledge and skills acquired during the training and internships. The counseling / mentoring / mentoring activity will be a continuous process over the 6 consecutive months. It

will consist in identifying and communicating solutions to prepare the implementation of business plans according to the chosen fields of activity. At the core of this activity approaches of the profile of the entrepreneur will be found (lda, Villardón & Elexpuru Albizuri (2012)), of their behavior (Barba-Sánchez & Atienza-Sahuquillo, 2012), of their attitudes (Potishuk & Kratzer, 2017) and their motivations (Barba-Sánchez & Atienza-Sahuquillo, 2017).

The activity involves focusing on the management and marketing techniques necessary for the development of the business financed by the project: substantiating the company's management (forecasting, organization, coordination-training, decision, control), optimizing resources, defining marketing strategies, exploiting the opportunities identified on the market, ; direct orientation of services / products to market needs and needs, etc.

Within this sub-activity, each program winner / counseling / mentoring / mentoring (face-to-face and group) meetings will be agreed for each winner of the business plan competition and will communicate continuously on the communication platform. The expert / grant relationship will be a dual one: consultancy on the issues of new business development and mentoring (one-to-one and group-type) mentoring.

b) Monitoring by the administrator of the entrepreneurship scheme for the operation and development of business. It consists in tracking the way the business plan is implemented, taking into account the information received in the counseling / mentoring / mentoring activities. Monitoring will focus primarily on resources, activities and results, according to the business plan indicators, with the role of proposing solutions to correct any errors during the implementation of the business plan. Thus, monthly monitoring reports will be made of newly established firms.

After the grant is awarded, it will be tracked how the grant is spent, in line with the selected business plan. Business operations will be monitored over a period of 12 months, both by checking financial and accounting records and by visiting companies.

There will also be two cross-cutting activities started in the first phase, which are designed to ensure adequate communication and potentiation of project outcomes:

- Awareness raising campaign for social accountability and active inclusion promotion, including; Documentation to raise awareness and raise awareness in the field of social accountability and active inclusion promotion; developing specific awareness materials and media awareness (printed materials, audio-video clips) and the Internet (communication platform); organizing and

conducting specific events. In the Center region, 25 sessions, classic / online on the communication platform will be made.

- Entrepreneurship analysis study, good practices and support measures. An analysis study will be carried out on the situation in the business environment at regional level through the specific research, study and analysis. Identify, develop and exchange good practices in entrepreneurship at local or regional level. There will also be 25 workshops / seminars on good practice in entrepreneurship across the region. During identification, good practice will be available on the online communications platform and / or database, the action being complementary to the activities of the first two phases. In developing the study, we will take into account recent approaches to this theme, such as Mironova, Dimitrov & Tsenkov, (2019), Garaika & Selatan (2019) and so on.

5. Conclusions and further research

Starting from the fact that "Romania Start-Up Plus" program is one of the first Romanian funding programs where universities play an active role, it is expected that the research undertaken within the PROFIT project and other projects involving 20 universities (see section 2) to make a significant contribution to the knowledge of the current characteristics of Romanian entrepreneurs and the way in which start-ups will be developed over the next two years.

Beginning with involvement in the PROFIT project, Spiru Haret University will assert its role as an entrepreneurial university in the Centre region and will actively contribute to regional development. It is anticipated that this involvement will bring about changes in the faculty curriculum in Brasov, by including disciplines to promote entrepreneurship and start-up development in non-economic study programs (eg Psychology).

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Content interaction in online university courses:
The start@unito project

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Abstract

The growing number of online courses offered by many universities worldwide is reshaping the traditional delivery of knowledge. This study tries to combine e-learning and the learning principles of language and linguistics. Drawing on the experience of the start@unito project at the University of Torino, which this year also offers language and linguistics courses, we tackle one of the main problems of online education, namely that of interaction. This study tries to combine e-learning and the learning principles of language and linguistics, focusing on the three types of interaction proposed by Moore (1989): learner-learner, learner-instructor, learner-content interactions. Specifically, we concentrate on the various ways in which learners may interact with the content in asynchronous untutored online university courses. Starting from the assumption that all the language and linguistics courses need a great deal of interaction, in order to be beneficial to students, it emerges that the application of pedagogical approaches and a careful instructional design of the courses may facilitate a more effective interaction with the content of the object of study.

Keywords: Content Interaction; E-learning; Online Interaction; Online Language and Linguistics; Online Teaching, Open Online University Courses.

1. Introduction

Nowadays a growing number of universities is offering their students new web-based learning environments in many subject areas and learning foreign languages and linguistics is not excluded from this phenomenon. The University of Torino has recently embarked on a new project called start@unito (Bruschi et al., 2018), which already offers 20 online open asynchronous courses in several disciplines such as Philosophy, History, Sociology, Physics, Mathematics, Informatics, Economics. In the spring 2019, 30 additional courses will become available, including 19 courses held in English, such as International Law, Business Law, Private Law, Macroeconomics, Marketing, Developmental Neurobiology, Mathematical Modeling and 6 language and linguistics ones (English, French, German, Portuguese, Russian, and Spanish). Online education brings about new concerns regarding the management of the online environment such as the necessity to adopt new teaching methods, the issue of learners' engagement, motivation, self-discipline and autonomy and the problem of interaction which is undoubtedly the most critical one. The issue of interaction strongly emerged during the second phase of the project precisely because we found ourselves dealing with many courses involving the presence and the study of a foreign language. Since the start@unito open courses do not involve the presence of tutors or forums because of the very nature of open online education, which is available anytime anywhere, the aim of the present paper is to analyze how a peculiar form of interaction can take place, namely, the interaction with content.

Our research revolves around the following questions: how can the principles of e-learning help in the creation of academic courses? How can interaction be achieved in an online asynchronous untutored university course, especially in foreign languages and linguistics ones?

2. Theoretical framework

With the advancement of technology and the subsequent growth of online courses and internet-based learning, there has been the urgency to redesign the online courses' curriculum, materials and outcomes, along with the necessity to reshape and adapt the standard techniques of teaching and learning in order to facilitate the incorporation of the pedagogical principles of teaching in web-based classes (Govindasamy, 2002). One of the main controversies is the lack of face-to face interaction, an issue that becomes even more pressing when language learning is involved. Nowadays, we are used to social media and to the fact that virtual interaction may replace the direct one but reshaping interaction in open online courses, which also lack the social dimension of forums and virtual tutoring, is not an easy task. The online courses offered at the University of Torino are not merely language courses, as we will explore more in detail in the next chapter, but the interactional

factor has been brought to our attention especially by professors of language and linguistics. Language learning theories, in fact, have always stressed the importance of interaction in the process of language learning. Together with instructional design, the application of some language theories such as constructivism, social constructivism, constructionism and the most recent connectivism may be helpful to create online courses, apply pedagogical approaches and provide learners with effective tools; this may encourage learners to be more independent in their learning process and in doing so to easily interact with the content. (Papert, 1980; Govindasamy, 2002; Bell, 2009). Moreover, the online courses offered in linguistic disciplines are not merely language courses. They are language and linguistics courses which means that they involve both an implicit and an explicit study of language. Normally students receive linguistic guidance and feedback until they reach at least an A2-B1 level of linguistic competence – depending on the language studied – that will enable them to become independent users of that language and concentrate on the meta-reflection on it. In the online context, however, independence is required from the very beginning.

In an online environment learners and teachers are independent in terms of time and location, but are somehow connected and able to communicate by the use of technological devices and an internet connection. In fact, e-learning enables students to attend virtual classes, download study materials such as texts, handouts, videos and sit exams virtually, on their own and at their own pace (Ali, 2015). Thus, independence and autonomy are fundamental traits of learning online and are required for an effective interaction with the content. This is even truer when it comes to language learning, in fact, the above-mentioned process follows a specific path which differs from studying any other subject and for this reason it requires a specific methodology that may facilitate language flexibility, fluency and effectiveness in social, academic and professional contexts (Lantolf and Thorne, 2006; Vygotsky, 1978).

According to Chomsky, learning a language is a process in which the learner is active and independent in the processes of acquisition, organization and memorization of information (Chomsky, 1980). Similarly, constructivism underlined the importance of learners' autonomy; in fact, the theory was mainly based on the assumption that learners should interpret the world and construct their own knowledge and understanding upon the foundation of their previous learning (Jonassen, 1991, Lightbown and Spada, 2006). However, the aforementioned approach considered learning as an individual and subjective process of learning without taking into account the external stimulus which may derive from interaction. Afterwards, this view was enriched by social constructivists who recognized that knowledge is an interactional experience and that learners construct their own understanding and knowledge through their social interactions in social contexts (Cochrane, 2014). Constructionism shares most of constructivism's view but emphasizes

the importance of the context and the environment of learning and its social interactions, in order to have diverse opportunities to learn (Ackermann, 2004). In recent years, a new learning theory has emerged, named connectivism; it mainly stresses the importance of social interactions, connections and information sharing in the development of learners' knowledge and learning (Bell, 2009, Siemens 2005, Downes 2010).

These learning theories all support the importance of interaction, especially the social interactions that happen between learners in a collaborative learning environment but it emerges that few studies have paid specific attention to the interaction with the content. In 1989, Moore suggested three types of interaction that may influence learning in online environments: 1. learner-learner interaction, which takes place among the participants of a class; 2. learner-instructor interaction, which refers to the communication between teacher and students. 3. learner-content interaction, which is mainly based on the contact between learners and the materials, the content and the subject matter proposed. This type of interaction promotes students' independence and supports the social-constructive view of learning in which students' autonomy lets them build their own thoughts, perspectives and knowledge and promotes problem solving (Moore, 1989; Moore & Kearsley, 1996; Anderson, 2003).

Although interaction has always been considered as a fundamental element of education, both in traditional and online courses it emerges that much research should be carried out with respect to the interaction with the content in online asynchronous courses. The experience with start@unito shows that interaction with the content does indeed happen; since it involves no human interaction and is therefore less spontaneous, it must be carefully planned during the phase of course design.

3. The start@unito experience

The start@unito project of the University of Torino aims to promote open online university courses in various scientific, legal, economic, humanistic and linguistic disciplines to students of the last year of high school, both as a means to ensure a smooth transition from high school to university and as a way to contribute to global knowledge. The courses can also be taken by regular students who work, live far away, or simply wish to study at their own pace. In the first year of the project, only courses held in Italian were proposed. As said before, in the second year, which is still ongoing, 19 courses of scientific, legal and economic area held entirely in English and 6 language and linguistics courses are currently being developed.

Having to deal with the issue of language so prominently, the lack of human interaction became a problem we could not ignore. What is more, the online courses are designed to be open and worth 9 ECTS, while normally the students who enrol in the Department of

Foreign Languages, Literatures and Modern Cultures also attend language assistantship courses, taught by mother-tongue or bilingual lecturers, along with the linguistics ones, taught by professors. The practical language lessons are organized in small classes attended by an average of 30 students, whereas the linguistics lectures held in a more traditional university class environment. Passing the language test is a prerequisite for taking the linguistics exam.

Of course, providing both the language and the linguistics training in one online course is proving quite challenging.

Drawing on the experience as instructional designer and assistant for the start@unito project, we have found out that many language professors have voiced concern about the lack of interaction available in the online open courses, which makes it difficult to monitor pronunciation, and spoken and written abilities. The majority of these courses start at a beginner A1 level (French, German, Portuguese, Russian, Spanish), whereas the English language and linguistics course starts at a minimum B1 level, so students already possess independence and autonomy at least at the language level. In addition, the linguistics course is taught fully in English, therefore it presupposes language knowledge, yet at the same time it is also a reflection on language. In other words, the linguistics component makes knowledge explicit and requires already a solid base of implicit knowledge (Hulstijn, 2005), thus involving conscious awareness and intention. The introductory linguistics course covers phonology, morphology, syntax, sociolinguistics, language history and academic writing. The challenge of the online courses is to put together these two aspects, the language and the linguistics ones, accounting for the three types of interaction that make language learning possible. In transferring the courses online, the main challenge instructional designers and professors had to face was precisely how to transform and adapt the different types of interaction to the online context, which does not involve the presence of tutors or forums.

As for the learner-learner interaction, it was previously pointed out that since one of the characteristics of open courses is unlimited enrolment, it would not be feasible to moderate comments and posts on blogs and forums. The learner-instructor interaction is also absent in a direct way; nevertheless, by designing the course according to the principles of multimedia learning (Mayer, 2005) and learning object theory (Bruschi and Perissinotto, 2003) the instructor makes the third type of interaction – the learner-content one – possible. Here we will focus on the third type of interaction, the learner-content one: in the online environment, content may refer to a variety of tools such as texts, handouts, recordings, videos, interactive pdfs, assignments, glossaries, quiz, online games, and external links to other resources. Before analyzing them in detail, it is important to point out that many instructors make the wrong assumption that students nowadays are highly proficient in using the available technologies. Technical competences should not be taken for granted

and tutorials always provided to explain how to approach and interact with the contents of the course, otherwise content interactivity is lost.

In the start@unito project, the main tools used to provide interaction with the content are the following:

- Active learning: instead of simply delivering distance lectures, videos can be interspersed with questions and feedback, thus encouraging the learner to reflect on the content and interact with the video. In addition, providing bite-sized content in the form of short videos allows mobile learning, which in turn offers more interactivity options and facilitates learning anytime and anywhere. Allowing students to be active also promotes their engagement, in fact another interaction-inducing technique relies on the alternation of written content and interactive pdfs. Interactive pdfs are not obtained simply by adding navigation buttons; video, audio files and hyperlinks can be inserted in order to transform a passive reading activity in an opportunity to actively engage with the content and be exposed to different types of media, which may suit different types of learning styles.

- Personalization and feedback: first of all, the very nature of open courses, which suggests but does not prescribe a progression of navigation, provides students with the option of picking and choosing contents according to their needs. The courses are organized in multiple layers of complexity, and different paths are suggested to those who are only browsing through the courses for orientation, wishing to complete the course and get a certificate or enrol at the university and sit the exam. A further personalization option is adaptive feedback, a way to design automatic differentiated responses to a question so that students who make a mistake can receive step-by-step guidance in solving a problem (Barana et al., 2018). Adaptive feedback also has a role in promoting self-evaluation and self-correction and in preventing feelings of frustration and isolation, should students not be able to understand their own mistakes.

- Using authentic materials: the lack of peer interaction is replaced by the presence of external links to websites, authoritative Youtube channels, and other authentic materials that work as an invitation for students to see the course as a point of departure to take charge of their own learning and expand it. The use of authentic materials to support teaching is particularly apt in the case of language learning. The creation of authentic tasks (Herrington, 2006) and the consistent use of the L2 promote learner's involvement through the immersion into the target community of practice (Little, 2004), thus scaffolding the development of autonomy.

- Using authentic, situation-based tasks: if a task has real-world relevance, it has a higher chance of being perceived as useful by learners. Authentic tasks are usually associated with the social constructivist idea of meaningful interaction, which is

enhanced by collaboration with peers (Woo et al., 2007). We would argue that meaningful interaction can also be obtained with the content, for example through the use of animations that use storytelling to simulate the real-class experience. For example, many start@unito courses make use of Vyond classroom-themed animations, featuring an animated teacher explaining a topic, asking or answering questions in a class. Learners can therefore identify with the students and reflect on meaningful questions and answers.

-   Promoting students' engagement: interaction with content is directly linked with students' engagement. It can be improved by using "furnishing" techniques, such as adding music and compelling graphics to help boost learners' motivation and attention level; by lowering the degree of formality in order not to add another distancing element in an already distance course; by using gamification techniques to elicit motivation for excellence. Especially in language and linguistics courses, students need to be exposed to both the informal and the formal language, and to master both the everyday and the technical vocabulary. At the same time, although gamification is unsuitable for approaching a complex subject such as linguistics, it works extremely well for language learning, especially for those languages which start at an A1 level. These courses also alternate the use of students' L1 and L2, so that they have time to adapt to the L2 while grasping essential concepts in their L1. This may pose a limitation to the openness of the project, but it is counterbalanced by the presence of courses in many different disciplines held entirely in English, and therefore aimed at an international audience.

4. Conclusions

Although the proliferation of online education has received attention from scholars both from the theoretical and the practical perspective, there is still much work and research to be done in the field. Online courses of foreign languages and linguistics are especially complicated to deal with because of their inherent necessity to provide guidance to beginner learners who are not yet autonomous, and a certain degree of spoken and written interaction. We have tried to offer a glimpse of what has been done so far to ensure that the only possible form of interaction, namely content interaction, will really take place. Yet, the start@unito project is still under way, so we have to wait until its completion to gather more specific data, both on quality evaluation of instructional design and course development and on students' fruition and learning outcomes.

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Bridge the gap between high school systems with less than twelve years of schooling and European Universities

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Abstract

The phenomenon of globalization that concerns the modern era, pushed by technological evolution, has led to several changes in the field of education. Not only are education policies of the single States adapting by directing towards European models: the possibility for a student to choose a university is increasing all over the world, too. In order to facilitate students who want to enroll at a European university and who come from countries with less than 12 years of compulsory schooling, the University of Turin designed the Foundation Programme. This is an additional year that allows to earn 60 or 30 ECTS to reach the 12 years of schooling, a basic requirement for university access in Europe. The main feature of this project is that it is delivered online; this allows to reduce the costs of enrollment and allows students to attend it directly from home in their country. The design, structure and methodologies of the project are described and discussed in this article.

Keywords: E-learning; Foundation Programme; Foundation Year; Globalization in education.

1. Introduction

To talk about globalization means to talk about everything concerning the planet, a phenomenon that is not new in human history, but which, especially nowadays, where technological progress dominates, has taken on a much wider dimension than in the past. Globalization has led to "in political terms, a certain loss of nation-state sovereignty, or at least the erosion of national autonomy, and, correspondingly, a weakening of the notion of the "citizen" as a unified and unifying concept, a concept that can be characterized by precise roles, rights, obligations, and status" (Burbules & Torres, 2000). Due to the strong interaction between state and education, globalization has also affected the educational field (Isaxanli, 2018), and an increasing number of countries are adopting a school system similar to the European or American model. Globalization has also led to an increase in internationalization in terms of mobility of students, teachers, Erasmus exchanges and internships. In Italy, data of the National Student Registry (ANS) show that the number of foreign students enrolling at an Italian university has been constantly increasing, and in the academic year 2017/18 it was over 23,000, which is about 6% of the total number of the students enrolled at an Italian university, with an increase of 8% when compared to a.y. 2016/17. The number of foreign students enrolled at the University of Turin is 6%, in line with the national average. Some of these students come from countries where the 12 years of schooling are not required as for the enrollment at an Italian university. To facilitate the integration of their pre-university education, the University of Turin has created the Foundation Program, an additional year that allows the achievement of 30 or 60 ECTS, according to their needs. It is delivered completely online: this way, international students can attend the program from their homes, without the need of a stay permit and without the costs of the travel and stay in our country. Only the final exam that allows to certify the ECTS is to be taken at the university, right before enrollment.

2. State of the art

2.1. Regulations for enrolling foreign students at an Italian university

As indicated by the Ministry of Education, University and Research, the enrollment of a foreign student at an Italian university requires the delivery to consular representation and institutions of advanced education, of, among other documents, "The final title in original (or certified copy) of secondary studies obtained with at least 12 years of schooling, or substitutive certificate to all legal effects; the final title can be accompanied as an alternative and at the discretion of the single institution of higher education by certification issued by ENIC-NARIC centers, by certificates of foreign official bodies or by Declaration of Value" (MIUR, 2018). On the same document there is a reference to article 6 paragraph 1 of Ministerial Decree 270/2004 for what concerns the university area, and article 7 paragraph 2

of Presidential Decree 212/2005 for the AFAM (Artistic, Musical and Choreutic Higher Education) area, which regulate the possibility for institutions of higher education to establish "preparatory education activities for admission to degree programs, offering preparatory courses (foundation course) even for a duration of less than one year, in order to meet the admission requirements for attending Italian higher education courses".

Several Italian universities have taken steps in this direction by activating this supplementary year, such as the University of Pavia, the University of Pisa, the University of Siena, and the University of Rome "Tor Vergata". What brings together these universities is the proposal of a foundation year provided either entirely face to face or through mixed activities both face to face and online. At a European level, the panorama appears to be much more diverse, both from the point of view of the objectives and from the point of view of the delivery of the Foundation Year, but there are numerous initiatives that allow foreign students to learn in a new study modality. The University of Turin has decided to set up its own introductory course in interactive mode completely online, self-paced, with the sole exception of the final exam, which has to be taken face to face.

2.2. Digital education at the University of Turin

The choice of entirely delivering the Foundation Programme via online courses was made for two main reasons. First of all, we wanted to try to cut the costs for the course attendance to a minimum by offering the possibility to attend it to people from disadvantaged regions, or to students who are not so much interested in enrolling at university as rather wishing to expand their cultural preparation or to learn more about Italian culture and language. The second reason is that an online course of this kind is part of the strategic action taken by the University of Turin to invest in digital education, a field in which it has gained experience and carried out research. In line with this, several initiatives were seized over the last years, with different goals and objectives. A first example is represented by Orient@mente, which provides all secondary school students with support in the preparation for the university and in a more informed choice of the academic path, by an open and free online platform (Barana, Bogino, Fioravera, Floris, Marchisio, 2018a; Barana et al., 2017a; Barana, Bogino, Fioravera, Marchisio, Rabellino, 2016a). The project Start@Unito pursues orientation purposes and offers a link between university and secondary school. It is an online platform containing numerous free access university courses that can be attended autonomously from the last years of secondary school and allow students to immediately acquire the university credits, upon passing the final face to face exam after enrollment. (Bruschi et al., 2018; Marchisio, Operti, Rabellino, Sacchet, 2018). While the previous initiatives target the students, there are also numerous online training activities for secondary school teachers. From a European perspective, in the SMART project - Science and Mathematics Advanced Research for a Good Teaching - two open online courses have been designed and implemented as intellectual outputs containing resources and useful activities for a continuous updating in

the teaching of teachers of scientific disciplines. (Brancaccio, Esposito, Marchisio, Pardini, 2016). At a national level, the University of Turin is a scientific partner of the ministerial project "Problem Posing & Solving", which promotes the creation of a community of learning and practice for teachers of the STEM disciplines of Italian secondary schools (Barana et al., 2017b; Brancaccio et al., 2015; Barana, Fioravera, Marchisio, Rabellino, 2017e).

3. The project "Foundation Programme"

The Foundation Programme is available at foundationprogramme.unito.it starting March 2019. It is in Italian and written in Italian, since half of the courses are on Italian language and culture. It offers two modules, one consisting of 30 ECTS and the other one consisting of 60 ECTS. The first 10 ECTS are completely open, so as to allow students to verify the actual interest for the path chosen whereas, in order to access the other courses, students need to enroll and pay the anticipated fee.

The design of the Foundation Program has been divided into different highly correlated phases: analysis of the student needs, definition of the educational objectives, the choice of the learning environment to be used and the summative evaluation of the path. A starting point for the choice of the design methodology was identified in the ELED (E-Learning Engagement Design) model (Czerkawski & Lyman, 2016), an Instructional Design Framework for Student Engagement which provides strategies to maximize the participation of students in an online course.

a) *Analysis of student's needs.* A student enrolling in the Foudation Programme might encounter two main difficulties: language, and the possibility to attend classes in a face to face modality. To provide for the first necessity, all the courses are in Italian, with an intermediate level of the language (B1-B2) and 30 of the ECTS to be achieved belong to the "Italian language and culture" module. The B1-B2 level is not required for the enrollment in the Foundation Programme, but it is the recommended level of language in order to easily attend the supplementary year and it represents a minimum basis so as to attend lessons of any degree course in an Italian university. As for the difficulty of attending the course in face to face mode, the solution adopted was, as already mentioned, that of providing the course in online mode. On one hand, it allows students to attend the course from their countries in total autonomy and at their own pace, while also containing costs, since they only need to pay for enrollment. On the other hand, this modality required us to adopt various methodologies that are able to stimulate the student in learning, to help him/her overcome obstacles, to trigger cognitive and metacognitive processes, to have self-evaluation mechanisms that allow him/her to check his/her progress. Moreover, since the course is completely online, there is no minimum number of

students required to be enrolled in order for the activation of the supplementary year, unlike some face to face courses.

b) *Definition of educational objectives.* The definition of educational objectives was made at different levels. The main educational objective of the course is to provide the student with the basic skills necessary for the enrollment in a university course, while each course was associated to two sub-levels of educational objectives. Of these two objectives, the first one regards the educational objectives of the single course, while the second one describes the specific objectives for each of the ECTS. This way, the student can consciously check his learning process, have clear all the steps and have more confidence in his/her progresses. This is of fundamental importance in the case of such online courses, where there is no tutoring or monitoring of the activity by a teacher. The choice of educational objectives was certainly a challenge for university teachers involved in carrying out the lessons, since they had to be designed for younger students with respect to their normal didactic activities, and therefore they had to reshape them both in terms of content and language.

c) *Choice of the learning environment.* Given the proven experience in the field of e-learning gained by the University of Turin with the Moodle learning management system, the latter was chosen as a learning environment. According to Dixson (Dixson, 2010) there are no significant differences between the level of student involvement and the type of activity proposed (with a distinction between active activities, such as discussion forums or problem solving activities, and passive activities, such as reading educational material, video lessons, etc. ..), but what really maximizes the involvement of the students are the interactivity and the interactions (student-teacher, student-tutor and also student-student). Since the Foundation Programme is delivered in a self-paced modality, interactivity is one of the aspects that were carefully taken into account in its design. Tools that allow immediate and interactive feedback were adopted, together with adaptive courses based on ongoing assessments and problem solving activities for the contextualization of the notions presented. The Moodle platform is integrated with an Advanced Computing Environment (ACE) and an Automatic Assessment System (ASS) that allow to guide students through personalized paths (Barana, Conte, Fioravera, Marchisio, Rabellino, 2018b; Barana, Marchisio, 2016b; Barana, Marchisio, Rabellino, 2015).

d) *Path evaluation.* The summative evaluation at the end of the path is divided into two parts. The first part is the autonomous one that only concerns the student, to whom a certificate of attendance is given online, after passing the test with automatic evaluation at the end of the course. The second part is the face to face exam for the

certification of the ECTS, to be passed in Turin, but recognized by any Italian university.

3.1. Structure of the "Foundation Programme"

Analyzing the needs of the students and taking into account the different number of ECTS needed for enrollment based on the years of schooling acquired, it was decided to provide the Foundation Program with two paths, one made of 30 ECTS and one made of 60 ECTS. The first one contains three compulsory modules: "Lingua e cultura italiana" (20 ECTS), "Letteratura Italiana" (5 ECTS) and "Storia contemporanea" (5 ECTS). The 60 ECTS path includes, in addition to the three above mentioned compulsory modules, a module of "Mathematical language and Problem Solving" (10 ECTS) which is mandatory, and two modules of 10 ECTS each that can be chosen among "Cinema and Music", "Law and Economics" "Languages and Cultures of the World" and "Sciences". The compulsory nature chosen for some of the modules is in line with the educational objectives defined during the design phase; the skills, abilities and knowledge provided by the compulsory courses of both paths are the minimum requirements not only for the enrollment at the university, but also for the education of the citizen and to facilitate the inclusion of students in the university and in the social sphere of our country. The first 10 ECTS regarding the "Italian Language and Culture " module will be available for free, but registration will be required in order to view the rest of the contents of both paths. The student will receive a certificate stating the passing of the final online exam of each module which will allow him/her to take the face to face exam in Turin. The latter will consist of two distinct parts: the first one, computer-based and related to scientific and economic-juridical lessons, will be carried out with the same automatic evaluation tool that the students got to know during the online course; the second one, oral and related to humanistic subjects, will verify the linguistic skills acquired by the student at the end of the course.

4. Results and discussion

4.1. Connection from secondary school to university

One of the main results in the medium and long term that we expect from the Foundation Program is the strengthening of the link between secondary school and university, reinforced with other projects of the University of Turin at national level. This international dimension represents a possibility for any student interested in coming to Europe for study purposes to fill any gaps in the easiest way possible, and to allow them to access the Italian university gradually but consciously. Other goals that we hope to achieve, also through the spreading of the initiative via various channels such as embassies and international fairs, is to offer the possibility to get to know Italian culture or to deepen the knowledge at a pre-university level.

Courses will be made available at the end of March 2019, so we will not be able to know how many students will attend them, and what nationality they are, for another year.

4.2. Professional training of university teachers

A result that has already been achieved is the training of the 18 university teachers who are in charge of the 8 modules. They were trained both in the use of educational methodologies that are specific in e-learning (communication strategies with videos, docimological training, design and implementation of on-line courses) and in the technical skills that concern content creation (ACE, AAS, video editing tools); thus, they acquired skills that can be useful beyond and after this project, as they can be employed in regular didactic too. These teachers are to be added to other university teachers who were already trained during other projects and who contribute to a deep innovation in university education. As for the preparation of materials, each teacher was supported by a grant holder who had been properly trained, because the teacher worked extra hours and beyond his/her regular tasks for this project.

4.3. Examples of digital educational materials

All the courses are currently under revision and completion. In the initial phases, a template for structuring the ECTS was recommended (introductory video, interactive material, formative evaluation, in-depth analysis and summative assessment), but during the implementation phase teachers were given complete freedom as of the elaboration of the various parts, according to the needs of the single subjects. The only specific request was constant interactivity, which had to be used both for the resources and for the LMS Moodle activities. The search for the most suitable solutions for the creation of interactive materials that allow the student to independently reach a specific educational objective has been particularly challenging in some cases, and has led to the discovery of new and interesting teaching tricks. Some examples of activities used are: tests with automatic evaluation consisting of adaptive questions with personalized feedback, interactive worksheets for the exploration of contextualized problematic situations created with an ACE that should develop problem solving skills (Barana, Fioravera, Marchisio, 2017c; Barana, Fioravera, Marchisio, 2017d), Moodle lessons. Examples of resources are: video lessons, interactive pdfs, and compilable Moodle pages.

Figure 1. An example of adaptive question.

Figure 1 shows an adaptive question of a test for the "Mathematical Language and Problem Solving" course, concerning the solving of a probability problem. The question is built with an interactive feedback, (Barana et al., 2018b) this meaning that, if the student gives an incorrect answer to the first question, a guided step by step procedure is proposed until the whole problem is solved.

Figure 2. An example of Moodle's page.

Figure 2 shows an example of wordsearch built on a page which allows the students to highlight the words in the box, to check the words found and to enter the solution in the appropriate area. This resource is proposed in the "Playground" under the Italian Language and Culture section. As for the History course, we were given access to the archives of the Library of the Italian Risorgimento Museum, the "Vera Nocentini" Foundation and the "Gaetano Salvemini" Institute of Historical Studies, which authorized the publication of unpublished materials, thus giving a remarkable originality to teaching.

The Foundation Program will be available not only to foreign students who need to obtain the twelfth year of schooling, but to all those who want to study, by purchasing the entire

course as a single 60 or 30 ECTS. Several requests have already been received from interested students from various foreign countries, such as Azerbaijan, Iran, Brazil and Egypt, driven mostly by the online feature and all the advantages that it entails. We can affirm that a bridge has been built to allow a real and modern internationalization of the university, which also means to approach university in this case the Italian one, in the best way possible.

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Multi-level governance in quality assurance in Spain: the case of the National Agency for Quality Assessment and Accreditation (ANECA)

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Abstract

This paper aims to examine the case of quality assurance in Spain, disentangling the evolution of the National Agency for Quality Assessment and Accreditation (ANECA), that made its way towards consolidation in a context characterized by deep policy transformations and by multiple actors involved. The case of ANECA and the Spanish context is particularly interesting because of the previous existence of several regional agencies before ANECA was created. These multilevel dynamics in quality assurance evolved over the years towards significant levels of coordination, but were not exempt of multiple conflicts. This case may contribute to assessing a gap in the literature: clarifying the role of quality agencies in implementing contested policy changes originated at the European level, identifying at the same time the complexities of multi-level governance.

Keywords: multi-level governance, higher education, quality assurance, Spain, ANECA.

1. Introduction

During the last two decades, there has been a radical transformation of higher education policies in Europe. The attainment of the objective of creating a European Higher Education Area (EHEA) set by education ministries in 1999 has promoted changes of higher education configurations of European countries, modifying the structure, practices and cultures of their university systems. The new policy paradigm for the governance of Higher Education Institutions (HEIs) — that was related to the transformative process focusing on European-wide harmonization — was characterized by a strong emphasis on quality assurance mechanisms, as well as incentive-based instruments (Olsen 2007; Dobbins & Knill 2014).

As a consequence, a new mode of governance for HEIs has emerged, both in regard to policy instruments and institutions. On the one hand, assessments of programs and institutions are now at the forefront of the policy, and standards aimed to define quality of teaching delivery, research activity and other activities performed by HEI are negotiated and implemented across all European countries (Blackmur 2007). In this sense, the governance of this policy field has largely moved, in many cases, from a command-and-control logic — often with the strong involvement of hierarchical academic communities — to a logic based on the principles of modern regulatory governance, where nudges, incentives and benchmarking inspire most policy instruments (Musselin 2014; Stensaker et al. 2011). On the other hand, the establishment of quality assurance agencies (QAAs) has also been crucial to this policy change, emerging as the most relevant actors to implement new policies, and working as "transmission belts" of relevant knowledge, particularly regarding new methodologies for quality assessment (Westerheijden 2007; King 2009).

In this paper, we examine Spain as a relevant case of these substantial policy changes, characterized by a strong multi-level character and an intense process of *agencification* in the field. In Spain, decentralization of higher education to the regions occurred during the 1980s, after the transition to democracy in late 1970s. This distribution came out as a consequence of the establishment of autonomous communities in Spain, when most education policies were devolved to the regions. It was within this context during the nineties that some Spanish regions decided to create quality assessment agencies to support universities, producing experimental policies aimed to improve university practices. The national agency, the ANECA, arrived later, in 2002, when leading regions had already established their quality agencies — in some cases these had already gained relevant expertise and international reputation in the field during the previous years.

Therefore, this paper focuses on analyzing the case of the National Agency for Quality Assessment and Accreditation (ANECA). The case of this agency is particularly relevant for studying multi-level policy dynamics, as it was established in 2002 in a moment when

various autonomous agencies were already in place. Moreover, this agency went through a process of consolidation amidst a context of open conflict with universities, particularly after 2007, when quality assurance processes became compulsory. Therefore, we think that that disentangling the evolution of this agency would help us to assess the transformation of governance in the field of higher education in Spain: *What strategies were put in practice by this agency to achieve its policy goals in such a conflicting arena? How has the relationship between this agency and the rest of the relevant actors involved (such as regional agencies and universities) evolved during this period? What impact did the European framework have on the process?*

This paper tries to answer these questions with a preliminary analysis of press, academic literature and legal sources. Additionally, four interviews with relevant informants were conducted, both from national and regional level agencies, as well as universities. Insight from these interviews is also included.

2. The Europeanization of HEIs: the role of quality assurance agencies

After some initial steps, in 1999, the Bologna Declaration became a turning point regarding program harmonization and regulation of quality in the field of higher education in Europe. In order to achieve this, in this Declaration the European Ministers of Education set the objective of establishing the European Higher Education Area (EHEA) by 2010 and foresaw the creation of a common assessment framework, based on a European network for quality assurance. On the one hand, accreditation procedures were provided by the European Association for Quality Assurance in Higher Education (ENQA), an association of agencies created in 2003 that promotes European co-operation in this field and disseminates good practices and other information-based resources. On the other hand, an understanding emerged that the implementation of this instrument, "accreditation as a guarantee of quality", should be performed by autonomous quality assurance agencies (QAAs), formally separated from governments and universities.

As a result of this policy process, independent or semi-independent QAAs have proliferated in Europe at various levels of government, becoming central actors of regulatory frameworks. In the case of Europe, the rapid implementation of Bologna-associated reforms, in particular since 2005, required a relatively quick harmonization of quality assessment regulation and practices introduced by the new quality assurance agencies. This policy acceleration in the late 2000s altered the traditional higher education governance systems in most European states, triggering at times considerable resistance to change, particularly by professional communities in universities. In this sense, as accreditation of university degrees became progressively compulsory, agencies were rapidly placed at the

forefront of the new system of HE governance, as those in charge of introducing the key ingredient in the new mode of governance.

The relevant but scarce literature on the governance of HEIs' quality assurance has paid considerable attention to the strengths and weaknesses of the variety of regulatory instruments used for assuring academic quality (Dill & Beerkens 2012), but it has paid less attention to the issue of how ministries and intermediary bodies (such as agencies) make decisions and develop their activities and interact on a daily basis with actors inside the sector, to make progress in move forward the implementation of new instruments according to their policy goals (Ferlie et al. 2008). Thus, this paper is also aimed at examining the level of conflict that emerged from the introduction of this new mode of governance within this policy area in Spain, and the role of the national agency in such a policy process. As we will examine, this conflict came from two sides: the universities, that showed resistance to the new policies, and from regional agencies, who saw the arrival of the new agencies as a threat to their competence.

3. Analysis: an overview about HEI policy in Spain

In Spain, the focus of external quality assurance are ex-ante and ex-post program evaluation and institutional evaluations. This quality assurance activity is performed jointly by the ANECA and 11 regional agencies[1], eight of which are full members of the ENQA, the umbrella organization that represents quality assurance organizations from the 48 countries that are members of the EHEA. These agencies are responsible for the quality assurance of higher education institutions, both private and public, present in their territory. In the regions without an agency, or an agency that is not a member of ENQA, the agency responsible for accreditation is the ANECA.

Hereafter, the evolution of this agency is explained in three main stages: the establishment of ANECA and the context in the early stage of the policy (1992-2003); ANECA's development and adaptation in a context of rapid policy change (2004-2010); and adjustments and revisions towards the agency consolidation (2011-2018).

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[1]The regional agencies that are part of ENQA are the following: AAC-DEVA: Andalusian Agency of Knowledge, Department of Evaluation and Accreditation; ACPUA: Aragon Agency for Quality Assurance and Strategic Foresight in Higher Education; ACSUCYL: The Quality Assurance Agency for the University System in Castilla y León; ACSUG: Agency for Quality Assurance in the Galician University System; AQU-Catalunya: Catalan University Quality Assurance Agency; FM+D: Fundación para el Conocimiento Madrid + D; UNIBASQ: Agency for Quality of the Basque University System. The remaining three agencies, which are not yet fully registered in ENQA, are the following: AQUIB: Agència de Qualitat Universitària de les Isles Balears; ACCUEE: Agencia Canaria de Calidad Universitaria y Evaluación Educativa; AVAP: Agència Valenciana d'Avaluació i Prospectiva.

3.1. The establishment of ANECA and the context in the early stage of the policy (1992-2003)

After the Declaration of the "Bologna framework", in 2001, the Spanish Universities Act (Ley Orgánica 6/2001 de Universidades, LOU) included the creation of an independent external body for quality assurance in higher education (in art. 32). Following this law, ANECA was formally established as a State public sector foundation (trust) by Ministerial Council agreement in July 19, 2002. At that moment, some autonomous quality assurance agencies were already created, such as the case of the Catalan, the Andalusian and the Galician agency. Therefore, the creation of ANECA introduced tension in the system, as regional agencies regarded this newly created agency with distrust (interview 02), and as the manifestation of the central Government's intention to establish a hierarchy between them (interview 01). This perception was intensified by ANECA's behaviour during these first years, as it largely ignored the rest of the agencies (interview 02) and tried to impose itself as a hierarchically superior agency (interview 2). In fact, during the first year of existence, there was no contact between ANECA and the regional agencies (interview 01).

However, the role of regional agencies was enhanced by ENQA's strategy of recognition of regional and state agencies on equal terms. For European authorities, the promotion of a "competition" framework between agencies was an objective which aimed to strengthen the extension and consolidation of the quality assessment model. But, on the other hand, the extension of the regional agency model in Spain clashed with its political and administrative tradition, based on the centralized regulatory control at the State political level. Therefore, in this first stage, the relationship between ANECA and the regional agencies was marked by the tension involved in determining the competence policy areas and the definition of the hierarchy and the collaboration system between the different regulatory bodies (interview 01). The pretension to establish hierarchy on the part of the central Government clashed with the political autonomy that regions intended to continue maintaining (interview 2).

3.2. ANECA's development and adaptation in a context of rapid policy change (2004-2010)

Since its establishment in 2002, ANECA went through substantial transformations that were influenced by the own construction of the EHEA. According to ANECA's report to the ENQA of 2007, the absence of specification of the approaches to be applied for the evaluation of higher education in the legislative framework determined "the commitment by ANECA's governing bodies to organize its evaluation processes in accordance with Standards and Guidelines for Quality Assurance (ESG) in the European Higher Education Area (EHEA)" (ANECA, 2007: 5).

In 2006, two years after the victory of the Spanish Socialist Workers' Party (PSOE) that ended eight years of conservative government, Gemma Rauret, former director of the Catalan regional quality agency, was appointed as the new director of the ANECA. She steered the agency in a period characterized by a crucial transformation of the Spanish system of quality assurance: its shift from being voluntary to being compulsory. This strengthened ANECA, since in order to operate, the universities needed the ANECA to produce a favourable report. Thus, in 2007, Royal Decree 1393/2007, 29 October, established a new qualifications system and defined a compulsory system of accreditation for degrees. As a consequence, ANECA launched a series of programs that intended to accredit all degrees in Spain within a period of three years, in parallel with the implementation of a system for the accreditation of university professors.

These programs were not welcomed by everybody. The implementation of a compulsory system in 2007 (particularly regarding the accreditation of programs and professors) encountered significant resistance in universities who maintained the new control formulas clashed with the autonomy principles. ANECA's role in this reform was also criticized. A common complaint during this period was that ANECA demanded too much information, much of which was considered irrelevant and even "absurd"[2].

In parallel, the ANECA and the regional agencies start working closely during these years. According to one interviewee, the creation of the Spanish Network of Agencies (REACU) in 2006 was crucial for this. In the REACU, ANECA and the regional agencies met several times a year to negotiate the criteria and methodologies of assessment (interview 1). Despite the initial resistance to participate, the Catalan agency AQU also joined this network in 2010 (interview 1).

3.3. Adjustments and revisions towards the agency consolidation (2011-2018)

Amid the economic crisis, the Popular Party (the conservative party which won the 2011 elections) started a reform process with the objective of reducing public spending and eliminating redundant administrative structures. The report written in 2013 by the Committee for the Reform of the Public Administrations proposed a series of measures for the re-structuring of the Spanish system of public administration, that included the fusion of public entities to avoid duplication[3]. In line with this, the report suggested the establishment of a unique accreditation body in the area of higher education (CORA, 2013:

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[2] Carlos Berzosa, "Sí a Bolonia, pero no así", 9 of June 2008, El País Madrid.

[3] http://transparencia.gob.es/transparencia/dam/jcr:16c7ed96-bab3-4adb-943e-6c1730dd5785/reforma-AAPP-ingles.pdf

112). Consequently, some regional agencies were afraid that this reform would trigger a process of centralization, that would reduce their area of competence (interview 03).

One year after, Act 15/2014 of 16 September transformed the ANECA into an autonomous body (art. 8)[4] and augmented its competences, putting the National Committee for the Evaluation of Research Activity (CNEAI)under its coordination, as recommended. The competences of the regional agencies remained, however, untouched, as the director of the ANECA at the time opted for respecting their area of competence (interview 03).

It seems, therefore, that the ANECA, when having the opportunity for centralization, opted for a model based on cooperation with regional agencies. Similarly, insights from the interviews show that the relationship with the other regional agencies were oriented, in this third period, by the mutual recognition and collaboration principle (interview 3). According to an interviewee from the AQU, "now the relation between the ANECA and AQU is of equals, (…) as we are all in the same European registry" (interview 03). It therefore appears that the role of this Registry has contributed to the ease of the territorial conflict. This is potentially due to the consolidation of the collaboration strategy over the hierarchy on the multilevel governance quality assessment system.

4. Conclusions

In this paper we present a work in progress examining the case of quality assurance in Spain, disentangling the evolution of an agency, the ANECA, that made its way in a context characterized by deep policy transformations and by multiple actors involved. Our goal has been examining Spain as a case of these substantial policy changes in Europe, to focus on several questions that try to better understand such a large institutional change.

So far, we were able to identify some factors that may explain the evolution of the ANECA, in a multi-level environment, with strong regional actors. On the one hand, we have seen that the ANECA interacted with the regional agencies and was able to overcome an initial inter-agency confrontation, moving to a more innovative and collaborative model of relations. In this regard, it seems that the fact that strong regional agencies were already in place when the ANECA was established, limited its margin of action and force the national agency to move to a model based on extended cooperation and information sharing with the existing agencies. On the other hand, the impact of the European policy framework in a domestic policy environment helped too to facilitate this transition to a more collaborative

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[4] Royal Decree 1112/2015, of 11 December, approved the Statute of the ANECA, which describes it as "a separate public legal entity, has its own Property and treasury as well as full legal capacity to act and use its power with complete functional independence" (art. 1.2).

interrelation between centre-periphery relationships. For European Institutions, the different agencies registered in the ENQA have the same consideration and action capacity, regardless of whether they are national or regional. This favoured the consolidation of a relational model guided by the principle of mutual recognition and collaboration.

To conclude, it must be noted that more evidence is still needed to adequately assess the evolution of this agency. Other possible explanations such as the impact of personal leadership should also be explored. In order to do that, more interviews are planned to be conducted. Proximately, we hope to add these results to this paper.

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Shared learning process among students of the Health Sciences and Electronic Engineering Department and students of professional training in the area of Technology and Health. A proposal for educational innovation

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Abstract

The objective of this proposal for educational innovation is to facilitate the learning of complex concepts and their relationship with reality, through peer-to-peer training, in where two scenarios will be shared: university and professional training.

We propose an experience in which University students in the area of Electronic Technology and Health, specifically from the degrees of Industrial Electronics Engineering, Physiotherapy and Nursing, previously trained in the concepts of radiation and its types, infrared radiation, its use in health in both treatment and diagnosis, thermoregulation and thermography with the visual thinking tool, can transversally share a teaching scenario with students of professional training in the technological areas and health in particular to the Superior Technicians in Clinical Electromedicine.

The execution of the project will be conducted during the month of February of 2019.

This proposal of training acquired between equals will produce greater efficiency in the results, generating a better adhesion in the teaching scenarios and a posteriori in the work environment.

Keywords: *Teaching transversality; Termoregulation; Non-ionizing radiation; Infrared radiation; thermography; Visual Thinking.*

1. Introduction

Facilitating that students' learning process should be effective is one of the goals of the teachers in all educational areas.

The European Higher Education Area (EHEA) proposes significant changes in the teaching-learning processes. On one hand in the learning approaches that university students use during their academic training, and on the other hand, in the methodological used and teaching strategies that have been implemented (Argos et al., 2013).

Learning approaches integrate both the motivation to perform a task and the strategies that will be used to achieve it. It is something complex, dynamic and continuous that affects deep processes of knowledge (metacognition) and the use, in practice, of the strategies necessary to achieve learning objectives (Tocci 2013).

When it comes to learning complex concepts and their relationships to reality, students manifest learning difficulties. In these cases, the use of traditional teaching methods is a failure for both the student and the teacher. Therefore, it is necessary to consider new teaching strategies for teaching-learning processes both in the learning approach and in the methodological approaches.

This proposal is part of a project of Educational Innovation and Improvement of teaching quality, Service of Lifelong Learning and Educational Innovation (SFPIE) of the University of Valencia and is part of the program "Renewal of Teaching Methodologies" and pursues. They include innovation projects of a general nature, aimed at discovering new methodological instruments and new techniques for improving teaching-learning processes (Uv.es, 2018).

In order to complete the experience, a multidisciplinary group has been set up, but it is unrelated to the different areas of knowledge involved (health professionals who combine university teaching, faculty who teach at the university and in professional training, etc.), being common to all of them with their nuances the knowledge, competences, and abilities.

In order to complete the experience, a multidisciplinary group has been set up, from there differents areas of knowledge involved.

The capacity for abstraction and planning are directly related to the ability to visualize, so people who use the visual representation system are more easily and quickly to acquire large amounts of information and establish relationships between different ideas and concepts (Velásquez 2006).

Howard Gardner (1993) in his theory of "Multiple Intelligences" describes eight types of intelligence, which includes the visual-spatial which is responsible for developing skills in the recognition and development of visual images, allowing mental models to be formed by

the analysis of the space that surrounds us, as well as the creation of spaces and images (Gardner 2010).

Continuing with this line of argument visual thinking is something innate to the human condition. The visual thought, although it was named by Rudolf Arnheim's in 1969 is a concept in vogue and revolutionized by Dan Roam after the publication of the book in 2010 "Your world in a napkin".

Visual Thinking means "take advantage of the innate ability to discover ideas that would otherwise be invisible, develop them quickly and intuitively and then share them with other people so they can understand them immediately. There is no better way to confirm that we really know something than by drawing it" (Roam 2010).

The visual thought is considered as a tool that consists in overturning and manipulating ideas through simple and easily recognizable drawings, creating connections between them by means of mental maps, in order to understand them better, define objectives, identify problems, discover solutions, simulate processes and generate new ideas.

For all these reasons, it has been considered that University students use as a didactic or methodological tool "Visual Thinking" to transmit knowledge to professional training in the technological areas and health in particular to the Superior Technicians in Clinical Electromedicine.

2. Objectives

1. University scope:
   - Make students aware of the benefits of visual thinking
     - improve the capacity for understanding and synthesis.
     - facilitates to express ideas when words are not enough.
     - triggers shared processes of thought, dialogue, design and action.
   - Train students in specific concepts about radiation, infrared, thermoregulation and thermography and its application in health.
   - Motivate self-learning e-learning.
   - Share the teaching scenario among already trained students to capacite others, through visual thinking, the Professional students in the specific detailed concepts.
2. Professional Training Area:
   - Encourage the participation of students. using active and contextualized methodologies that facilitate the participation and involvement of the student as well as the use of communication strategies based on the role to be developed in the experience.
   - Encourage teaching-learning habits and professional procedures.

- Create a climate in the classroom of collaboration and positive communication.
- Encourage self-taught learning by focusing attention on practical issues.

3. Methodology

The contextualized methodology to be used in this proposal contains the following steps:

A. University students:
    1. Attracting university students to participate in the experience.
    2. Conducting an initial training seminar for volunteers university students who wish to participate in the experience, which will consist of two parts:
        a. Session in which it will be held to presentation of the proposal, objectives, methodology to be followed and knowledge to be achieved. In addition, a theoretical-practical explanation of visual thinking.
        b. Session of exposition of the specific knowledge to be acquired in order to transform with visual thinking and share in the university teaching scenario-professional training.
    3. Motivational presentation for self-learning e-learning about the tool. Study outside the classroom of the theoretical-practical contents to be transmitted (flipped classroom).
    4. Realization of the teaching material using visual thinking.
B. Carry out the transversal experience in university teaching-professional training.
C. Experience evaluation: A self-administered questionnaire based on the Likert scale:
    1. Evaluation of the knowledge acquired.
    2. Assessment of the degree of acceptance, degree of satisfaction with the experience and the difficulties encountered.

Tool Visual thinking is a creative methodology of reflection and action that is used to process information through the use of drawings, images, connectors, graphics, words and numbers in a simple way. It is structured in four steps or phases:

1. *VISUAL MAPPING* Search and collect the most relevant information on the subject that you want to work.
2. *VISUAL EXPLORE*. Select the data that interests us and start to pose grouping patterns using six questions: What, Who, When, Where, Why and how. In this way we are able to visualize the most relevant data.
3. *VISUAL BUILDING*. Interpretation and transformation of words into images that is constructing them visually. Depending on the data there will be different ways of visualizing it.
4. *VISUAL TESTING*. Communicate clearly and concisely what you want to express, supporting a story linking data and drawings.

The most outstanding benefits of this schematization technique are, on the one hand, paying more attention to identify what is important and relating ideas and on the other it allows us to remember in a better way, since conceptual and visual memory are used.

4. Implementation of the proposal

The steps that we have implemented are the followings:

Step-1 — **15 days**

Attracting university students to participate in the experience

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Volunteers

- 3 physiotherapy students
- 3 engineering students
- 1 nursing student

_____

Step-2 — **3 days**

Initial training seminar university students

- Presentation of proposal
- Exposition of the specific knowledge
- Exposition a theorical-practical Visual Thinking

Step-3

28 days

Motivational presentation for self-learning e-learning about the tool

Team work

Flipped Classroom

Networking

Teaching material
Visual thinking

Revision of teaching material by teachers

_____

Step-4

1 day

Development of the experience *shared learning*

7 university students and 9 students of professional training

Evaluation of Knowledge

True-false questionnarie

"Kahoot"

Evaluation of satisfaction degree

Likert questionnaire

"on paper"

Figure 1. Implementation of the proposal

5. Results

Being a proposal, we can talk about expected results, closely related to the contribution of the implementation of this teaching tool and the cross teaching experience sharing scenarios. For these reasons, we expect the following results (tables 1 and 2):

1. Acceptance of the experience by the students.
    -   University students.
    -   Professional Training students.
2. Satisfaction of the experience.

Table 1. Expected results on acceptance and satisfaction.

	Acceptance Teaching Experience	Satisfaction Students
University Students	100% Good-Very Good	100% Moderate-High
Professional Training Students	80% Good-Very Good	75% Moderate-High

3. Participation of Professional Training Students.
4. Acquisition of visual thinking knowledge.
5. Knowledge about the use of thermography in health and its theoretical bases, based on the contextualized skills and competencies of each degree.

Tabla 2. Expected results on acquired knowledges.

	Acquired Knowledges	
	Visual thinking	Thermography in Health
University Students	100% Adequate-Very Adequate	100% Adequate-Very Adequate
Professional Training Students	90% Adequate-Very Adequate	75% Adequate-Very Adequate

After the implementation of the experience we have obtained the result of the evaluation:

- Acquired knowledge's: 72,86 % correct answers and 27,14 % incorrect answer.
- Acceptance and satisfaction: the expected results they match with the results obtained.

6. Conclusions

This type of learning-teaching activities are very interesting because they motivate students and provide them with a continuous added value that will allow them to discover and strengthen skills that will be a great help in their learning processes incorporating this new approach.

Students consider the experience of sharing learning as very satisfying. The knowledge acquired through visual thinking is considered good or very good

Sharing teaching scenarios University-Professional Training is engaging for the implementation of competencies necessary for professional development.

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Clinical simulation: innovative educational project in basic cardiopulmonary resuscitation and advanced in pediatrics and neonatology

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Abstract

Introduction: Nowadays, clinical simulation could be a key link in the teaching and learning of different procedures.

Methodology: It is a quasi-experimental study, using three evaluation questionnaires as a method to collect the respective information to the acquisition of competences and satisfaction of the students regarding a theoretical-practical training on pediatric and neonatal CPR for students of 2nd year Nursing the University of Valencia. To this end, 17 RCP laboratories formed by 228 students were carried out.

Results: The students gave a great reception to this project, giving it a score of 8.82 (SD 0.42) out of 10. The most valued item (by the students) was that in which other students were recommended to do the Pediatric CPR laboratory with a 9.53 out of 10. Student knowledge improved in 7 of the 11 questions and worsened in 4 of them. The one that improved the most was the one referred to the intubation time.

Conclusions: After the simulation, most students said that despite having lived a stressful time they would like to be able to perform more simulations to be able to better fix the theoretical knowledge.

Keywords: Cardiopulmonary resuscitation; Pediatrics; Clinical simulation; Educational teaching; Educational innovation.

1. Introduction

The program of Educational Innovation in basic and advanced CPR pediatrics and neonatology is included within the subject "Nursing in Child and Adolescent Health" (ESIA), taught in the 2nd year of the degree in Nursing of the Faculty of Nursing and Podiatry (FIP) of the University of Valencia. It is part of a project of Educational Innovation and Improvement of Teaching Quality of the Servicio de Formación Permanente e Innovación Educativa (SFPIE) of the University of Valencia. This project seeks to experience scenarios where projects are included of innovation of a general nature, aimed at discovering new methodological instruments and new techniques for improving the teaching-learning processes.

In this educational program, taught in the academic year 2017/2018, several clinical situations of the critical pediatric and neonatal context were designed. In these simulations the students of the ESIA subject had to face different scenarios to implement the knowledge, skills and attitudes acquired throughout the academic year. This type of training is based on the new educational paradigm, requires a training of students based on competence. To achieve it, we should incorporate new materials, new methodologies and introduce practices in teaching, thus achieving improvements in the teaching process - learning (Calveras, 2003).

The students must be exposed to clinical situations in order to discuss possible solutions. Therefore, the incorporation of clinical simulation in nursing teaching is important, since the professional future will face complex and changing dilemmas to which it must be able to cope (Figueroa, 1999).

Clinical health simulation is defined as a controlled situation of reality. In the case of nursing, it is considered the experience that mimics a realistic environment and that requires individuals or simulators to demonstrate, practice or learn procedures or techniques. Besides, taking decisions and develop a critical thinking in order to provide quality care and insurance for the patient are also of interest (Guimond, Sole, & Salas, 2011; Urra, Sandoval, & Irribarren, 2017; Jeffries, 2005).

According to Gaba, considered in some manuals as the "father of simulation", simulation is a teaching technique and not a technology, which should be used to replace or amplify real experiences in guided experiences that replicate substantial aspects of the real world in a interactive way (Casal, 2016; Gaba, 2004).

2. Project

Over the years, students of 3rd and 4th have studied other subjects where they have done activities related with CPR in adults but not in children or infants. For this reason, it is

essential that these students have direct contact with the practices and instruments of the child and neonate dummies to consolidate the knowledge they acquired during previous years.

With the purpose being able to repeat the laboratory it was decided to design this teaching program in collaboration with other subjects (Medical-surgical Nursing, Practicum III, IV and Emergencies and Out-of-Hospital Emergencies), and thus consolidate knowledge and skills within the framework of urgent assistance in the child and serious neonate who needs basic and advanced life support.

The expected results are specified in a special way both in the acquisition of technical training and teamwork with clear objectives. Also of interest are the handling of adequate and specific material, in an environment of difficulty close to reality and in an environmental simulation, with the coordination of the professors of the different subjects and health professionals in active service. These aspects give this program solidity and a high level of experience and perception of the seriousness of the pediatric and neonatal patient before a future action.

The 3rd and 4th year students who participated as monitors in the educational innovation project received prior training, in which they had to respond to the clinical cases raised (cases that were subsequently implemented as monitors). This has allowed them to equip them with the essential qualifications to be able to train the 2nd year students themselves. In addition, it has served to strengthen the knowledge already acquired in their passage through the subject, as they themselves are teaching others classmates.

3. Aims

The objectives of the project were:

- All the students of 2nd nursing grade, after the subject of Nursing in Child and Adolescent Health, must know how to correctly perform a CPR in pediatrics.
- Strengthen the population knowledge about pediatric CPR of all 2nd grade students as well as improving the knowledge of 3rd and 4th grade students who participate as monitors.
- Evaluate the knowledge on pediatric CPR before and after the educational intervention, as well as the satisfaction of the students regarding this teaching methodology.

4. Metodology

It is a quasi-experimental study (not controlled) with pretest and post-test, using three evaluation questionnaires as a method to collect the respective information to the acquisition of competences and student satisfaction.

In order to develop the project, 17 CPR laboratories (2 hours duration each) were carried out, in which participated 228 students from the 2nd year of Nursing in Child and Adolescent Health participated.

In practice, seven students from the 3rd and 4th grades of Nursing and 16 nurses participated as monitors of the simulation. Previous and acquired knowledge was evaluated by means of two tests (pre-test and post-test) as wll as the satisfaction of the students with respect to the laboratory by means of a questionnaire passed at the end of the simulation.

The questionnaire to evaluate the satisfaction was anonymous. It was intended to know the opinion about the development of the training, and thus identify elements of improvement.

The questionnaire consisted of 20 items, scored from 0-10 according to the degree of satisfaction or agreement that the students had in this respect, with 0 being the "lowest level of satisfaction or totally disagreeing" and 10 the "grade" highest satisfaction or to be totally in agreement ". Several aspects related to the laboratory were evaluated: laboratory utility, methodology, organization and resources, teaching equipment and general evaluation.

The evaluation of knowledge was carried out with two tests: one before starting the laboratory (pre-test) and the other at the end (post-test). Both questionnaires, like the satisfaction questionnaire, were anonymous, and contained 11 questions. The format was multiple choice questions, only one being correct. For the post-test only the order of the questions was different from the pre-test.

Prior to the laboratories of the subject where the clinical simulations were developed, a theoretical class was given to the students of the 2nd year, where the recommendations of 2015 of the European Resuscitation Council on pediatric and neonatal, basic and pediatric CPR were explained. Subsequently, between April 24 and May 11, 2018, simulation laboratories were carried out. Approximately 15 2nd-year students participated in each laboratory. Three clinical cases were carried out in which the scenario created for this purpose was that of a subway accident where there were multiple victims.

Each case was supervised by a member of the innovation group and the distribution of them was done in the following way:

1. Advanced CPR on pediatric patients 2 years: ESIA teacher.
2. Instrumented CPR in premature RN: student of 3rd or 4th year attached to innovation.

3. Basic CPR in a 2-month-old infant: 3rd or 4th year student assigned to innovation.
4. Flyer assessment of the tutors: FIP professor assigned to innovation.

The tutor in each case was in charge of evaluating the intervention of the students. The external evaluator was responsible for evaluating through a check-list both the students of 2nd grade and the monitors assigned to the innovation. At the end of the laboratory an analysis of the overall evaluation (debriefing) was carried out.

The distribution of time and functions was carried out in the following way:

Table 1. Distribution of time and functions in the laboratory.

	Previous	First part	Second part
Time	10 minutes	60 minutes	50 minutes
Instructors (students and teachers)	Deliver pre-test	Tutorize assigned clinical case	Collaborate in the evaluation of students
Evaluating teachers	-	Fill check-list	Lead the evaluation of the laboratory (debriefing)
ESIA students	Fill pre-test	Realization of clinical cases	Active participation. Fill in post-test and satisfaction survey

Source: García-Molina, Pablo et al. (2018).

This teaching methodology is important for training of handling an emergency situation because this is very difficult to train and assess during actual emergency. When a critical situation occurs, there is no time to think about what the next step will be. For this reason, it is essential to practice the protocol of action as well as knowing what actions should be performed. The only way to practice an emergency situation (in this case cardiopulmonary resuscitation) without endangering the patient's life is through a simulated environment (De la Horra, 2010).

5. Results

The results of the satisfaction survey are shown in graph 1, where the score for each of the items appears. The average mark awarded by the 228 respondents is 8.82 (SD 0.42) out of 10. The item most valued by the students was 20 (laboratory recommendation) with 9.53 (SD 0, fifty). On the contrary, the worst rated item was question number 6 (teaching methods) with 8.08 (SD 0.52).

Graph 1: Satisfaction survey results.
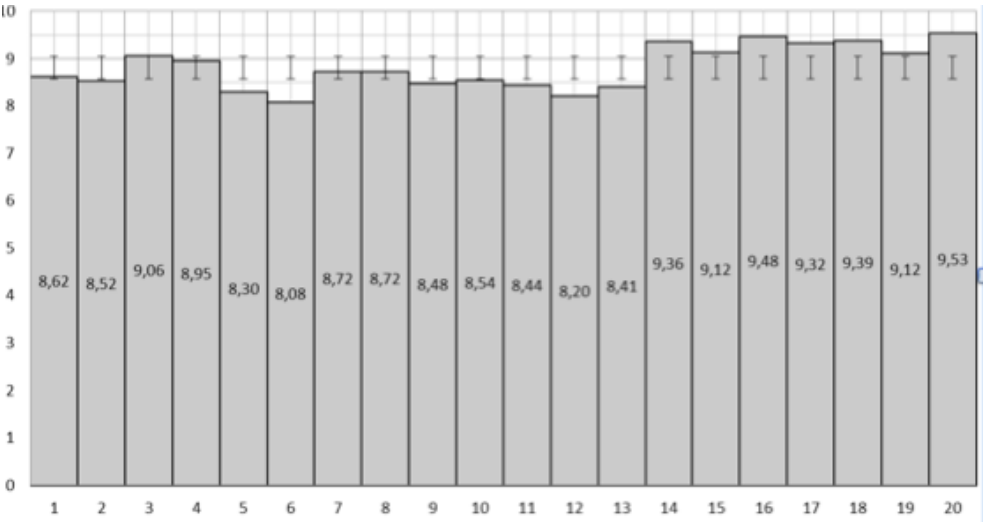
As for the results obtained in the pre-test and post-test, shown in graph 2, the percentage of correct answers and errors in each of the questions is reflected.

Graph 2: Pre-test results vs post-test.
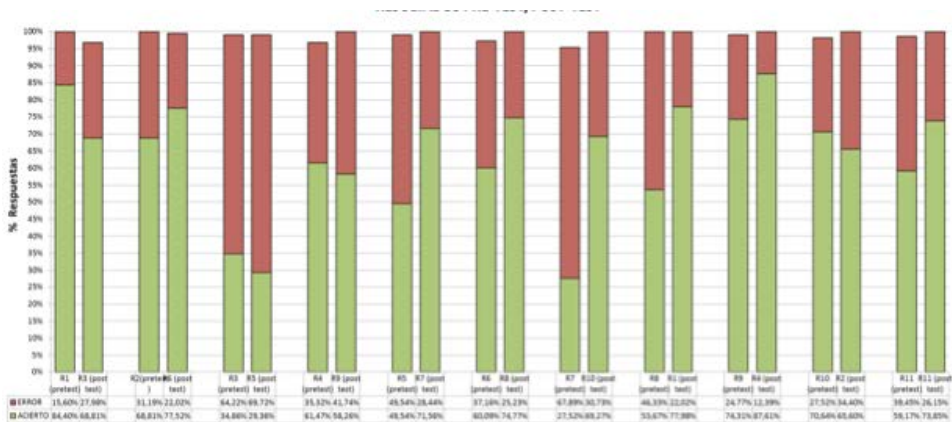
Source: Own elaboration.

The question that received the most success from the pretest was question number 1 (compression-ventilation ratio in children under 2 years). It was guessed by 84.40% (192) of the students. The question with the fewest guesses in the pretest was 7 (intubation time), correct by 27.52% (63) of the students. However, this question was the one in which more

improvement occurred, raising the percentage of correct answers to 77.98% (178) corresponding to question 11 of the post-test.

Regarding the posttest, the question with the most correct answers was the 9th post-test (material used in an instrumentalized CPR) with a success rate of 87.61% (200). In this question, the percentage of correct answers was increased by 13.3% (30) compared to the pre-test. The question with the least successes of the post-test was 5 (chest compression depth of 5 years). This question was answered only by 29.36% (67).

6. Conclusions

The simulations were very well received from students. Although there were stressful situations, many of the students said it was the best way to learn. In addition, it also served to reinforce the knowledge of the students of 3rd and 4th grade of Nursing. For future simulations, the students asked for smaller groups to be made and for more laboratories to be done. Another topic that was also commented was the subject of the material. The students often knew what material had to be used, but not how to use it. In summary, the simulations did not leave any student indifferent and most of them considered that it should be done in other subjects.

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Applying an integrated approach to social media communication training: how innovative thinking is changing the way universities teach (Web) journalism

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Abstract

This paper focuses on the challenges of teaching Internet-based communications, an inherently difficult task given the rapid pace of technological innovation in the discipline. The analysis it offers has been based on the findings of empirical studies conducted over the past five years by KZBerri, a University of the Basque Country-based research group focused on teaching innovation in Web journalism courses that form part of the curricula of the school's undergraduate journalism, audiovisual communication, and advertising and public relations degree programmes. The authors highlight two online journalism teaching innovation initiatives, one entailing a collaboration between students and media professionals, and the other entailing online collaboration between groups of students pursuing undergraduate communication degrees at universities located in Spain, Portugal and Brazil.

Keywords: teaching; innovation; university; journalism; transmedia; online collaboration

1. Introduction

Over the past few decades, the University of the Basque Country (UPV/EHU) has made a concerted effort to exploit the potential of technology in general and Internet technology in particular to enhance the educational programmes it offers. Professors in every department have striven to update curricula by making innovative Internet-based tools such as blogs, websites and social media an integral part of the teaching-learning process. This is in keeping with a general trend: more and more educators are using social media tools to refine their teaching approaches and boost student engagement and interaction (Cochrane, 2014). The user-friendly characteristics and free access policies of many blogging platforms and the opportunities these sites provide to produce content integrating text, images and sound have made blogging one of the most frequently employed and studied forms of Web-based technology in the sphere of education. University journalism programmes have given blogging an increasingly important role in undergraduate courses on the basis of research findings confirming its value as a tool for acquiring digital and online skills.

It is widely acknowledged that the future of the fields of journalism and communication hinges tightly on their ability to embrace technological innovation and consolidate professional practices for Web-based media. This paper explores recent approaches to teaching these disciplines that have fostered the fuller integration of techniques related to multimedia convergence and social media communication into university curricula (Carrie & Kraeplin, 2003; Tarcia & Marinho, 2008). The initiatives described here have been based on the assumption that training in convergent media (multimedia, transmedia, cross-media, etc.) and journalism 2.0 will continue to form a relevant part of university communication curricula for decades to come (Bhuiyan, 2010; Cochrane, 2014).

In light of this prospect, this paper highlights two successful teaching initiatives in which the research group KZBerri has played a role: the first of which was a collaboration between the University of the Basque Country's master's programme in communication and the Basque public television network during which graduate students produced transmedia content hand-in-hand with professional journalists and the second an international, multimedia, collaborative teaching project linked to Online Newswriting, a course that all second-year communication students at that university are required to take. Although Online Newswriting and other courses devoted to online and multimedia communication currently being offered at the University of the Basque Country reflect a decade of teaching innovation that began with the implementation of the European Higher Education Area, their cutting edge nature has supposed the need to review and update them on a periodic basis to ensure they keep pace with ongoing changes in sector technology and practices.

In fact, courses on Web journalism focusing on news writing can be effective vehicles for teaching the journalistic applications of social media and how media convergence has changed the manner in which journalists carry out their work. These two issues have long formed the crux of questions raised concerning how university journalism curricula should be structured and what material they should cover (Bhuiyan, 2010; Bor, 2014; Scott, 2002).

Keeping in mind the ways in which the professional profiles and skills of online journalists are evolving, this paper also explores key topics that Web journalism curricula should now address, from media convergence and forms of multiplatform communication that employ social media, multiple narratives, etc. to the emergence of a new culture of work that requires individuals to demonstrate a high level of flexibility and strong multi-tasking and collaboration skills on a daily basis. Universities need to address current workplace realities, and Web journalism courses offer an effective means of ensuring that media convergence and journalism 2.0 are covered in communication curricula (Larrondo & Peña, 2018)..

2. Web journalism training at the university level: the evolution of teaching approaches in the context of multimedia convergence and communication 2.0

Since the emergence of online media in the mid-1900s, the profession of Web-based journalism has been immersed in an ongoing process of evolution driven by technological innovation. Experts have pointed to the need to align the content of (Web) journalism courses and approaches to teaching this subject more closely with the roles students will eventually be expected to assume in a sector marked by rapid technological change (Deuze, 2001).

The multiplatform technology that has emerged in tandem with connected devices and social media has added new dimensions to the journalistic profession and drawn researchers' attention to the subject of online journalism. Practically all news companies operating today are engaged in one form or another of technological conversion in the wake of media convergence, transmedia storytelling and data-journalism. Each may be charting out an individualised roadmap based on specific cultural and financial considerations and a specific business strategy, but all are looking for journalists prepared to flexible on the job who thrive in collaborative environments and are capable of producing content in various media.

When educators began to teach online journalism, writing for online media was their primary concern. What followed was a tendency to apply teaching approaches that had worked for print journalism to its online counterpart while attempting to address the novel hypertextual, multimedia and interactive aspects of new media as well. Over time it became clear that online communication professionals needed certain skills that journalism degree

programmes weren't providing. As one scholar observed, "employers are requesting that applicants possess skills in web content creation, multiplatform adaptability and social media, while theoretical knowledge and basic writing and communication skills remain top requirement" (Bor, 2014).

Innovation in both professional Web journalism and academic research on that specialised field has since prompted educators to reconsider current teaching practices and ask themselves: what type of training do future online journalists need in order to practice their profession in a constantly changing environment in which they are expected to multi-task, collaborate with others and produce multimedia content on a daily basis? It is reasonable to assume that students wishing to enter the field must learn to distinguish between the differing possibilities for constructing multiple narratives that hypermedia, multimedia, multiplatform and transmedia offer. Storytelling options currently open to web journalists fall into four basic categories:

a) Hypermedia and multimedia Internet-based stories. Both of these options permit a journalist to use various means of expression (writing, video, audio and graphics) to construct a story – the first in the form of juxtapositions and combinations supported by links and the latter in a more integrated fashion made possible by dynamic programming languages.

b) Single media textual, audio, video or photo gallery stories created for online distribution that can be adapted as desired for multiplatform or cross-media use, common combinations of delivery channels being television and the Web, radio and the Web or a print publication and the Web. Multiplatform distribution decisions are made after content has been produced.

c) Stories envisioned as multiplatform content from the outset. This type of content calls for teamwork, takes more time to execute and requires sufficient prior planning and understanding of the narrative possibilities and limits of each medium involved in order to ensure that the end product is suitable for every medium envisaged.

Journalism has been enmeshed in a decades-long process of reinvention that has centred on using new digital tools to deliver news and information in a more compelling and effective way. Job profiles in the sector have evolved as a result. Journalists are now forging careers as multimedia content development managers and digital storytelling specialists, particularly in the area of visual communication. Although there are always exceptions to the rule, most journalism enterprises are pursuing corporate or newsroom convergence projects that involve journalists working in different media to coordinate their coverage or enable a wide range of professionals to form multidisciplinary teams with the capacity to produce content for more than one medium.

d) Transmedia stories and reports, the most innovative option open to online journalists today. Transmedia journalism employs a variety of media to tell a single, composite story. The power social media users have to extend and enrich narratives through interaction and participation makes audience engagement a crucial aspect of this approach (Jenkins, 2003). Transmedia production allows journalists to use every medium employed to its best advantage and explore different facets of a story in a wide variety of ways (viral videos, webdocs, special reports, radio and television programmes, tweets, posts, etc.).

3. Innovative approaches to teaching online journalism

3.1. Transmedia narrative

In line with the goal of helping students become well-rounded communicators, journalism training at the university level needs to stress the importance of adopting a positive attitude towards teamwork, multitasking and collaboration with other professionals. In this regards, despite the efforts media organisations have made to restructure their newsrooms to suit current circumstances, they continue to grapple with the fact that content production in innovative formats such as transmedia requires longer production time frames, greater resources and special skills related to social media 2.0 communication -capacity to connect with audiences in a manner that fosters engagement and the viralization of content. Transmedia content production also requires a high level of coordination and the involvement of professionals who know what works best in a range of media (Jenkins, 2003; Pratten, 2011).

Universities have responded to the dilemmas facing the sector by developing innovative new courses that help students gain hands-on professional experience, develop the social media and teamwork skills they need to secure entry level Web journalism positions and thrive in multimedia, interactive and digital environments. Some institutions of higher learning have also developed research groups focused on the challenges confronting the sector today or training programmes for working professionals interested in expanding their knowledge of multimedia journalism. Some of the more outstanding initiatives in this area include Integrated Journalism in Europe, an interdisciplinary project being carried out by five European universities; and the Knight Digital Media Center, aimed at helping journalists and other communications professionals strengthen their digital news production skills.

Other projects focus on the development of teaching techniques that are subsequently tested in what are referred to as 'media labs.' Outstanding initiatives in this category include Harvard's Nieman Journalism Lab, the Massachusetts Institute of Technology's Media Lab and Open Documentary Lab, the MMLab developed by the University of the Basque

Country in the context of its master's programme in multimedia communication, amongst other. Periodic and on-demand courses and training modules provided by Google News Lab also help reduce the digital knowledge gap plaguing the sector.

Universities are increasingly placing a heavy focus on transmedia training. Students enrolled in the *News21*, a communications programme funded by the Carnegie Corporation and the Knight Foundation, for example, were required to produce web-based multimedia documentary content. The University of the Basque Country's master in communication programme also covers students' multiplatform and multimedia production.

Students enrolled in this master's programme have participated in the last decade in KulturLab initiative, an annual week-long event held in a different location each year during which future professional communicators have the chance to create multimedia and transmedia projects focusing on some of Europe's most exciting cities. Specifically, the 2012–2013 collaboration between this master's programme and the Basque public broadcaster EITB gave KulturLab students the opportunity to provide 'docu-reality' and transmedia coverage of the Korrika, an multi-day foot race organised in the Basque Country every other year to raise funds for AEK, an organisation devoted to the teaching and promotion of the Basque language. KulturLab students produced viral videos, TV reports, television and radio programmes and 'twittersodes' related to this event. Initiatives such as KulturLab, which has generated highly positive feedback from students and faculty members alike, reflect a general shift towards post-graduate teaching approaches providing a balanced mix of theory, multimedia techniques and practices, and hands-on experience.

Students must become familiar with an ample range of social media platforms, learn to use in-house content to create online communities and ensure user loyalty and develop the skills they need to become adept community managers. Gone are the days when media enterprises dove headfirst into social media without a road map. Any media enterprise today with the budget to do so has a well-planned social media strategy. Larger organisations such as the BBC, Reuters and The Washington Post have even issued internal journalism 2.0 style guides.

3.2. Internationalization at home and online collaboration

Throughout the current academic year, KZBerri has been actively engaged in a UPV/EHU-funded international teaching innovation project titled "*Virtual Collaborative Learning in Online Newswriting: A Brazilian–Portuguese–Basque Experience*". During this time, researchers distributed survey questionnaires to students and professors presently involved in the course, organised face-to-face and virtual discussion sessions with these two groups and conducted ethnographic observation sessions in classrooms to assess the effectiveness of teaching strategies applied in the multimedia and transmedia aspects of Online Newswriting, a course that all students enrolled in undergraduate degree programmes in

journalism, advertising and public relations and audio visual communication at the University of the Basque Country are required to take.

The first phase of this international initiative, titled "Cooperative Learning in Online Newswriting through Web 2.0: a Brazilian–Basque Experience", was a collaboration between UPV/EHU and a university located in Brazil that ran from February 2017 through December 2018. The second, which began in February 2018 and will terminate in December 2019, involves two new partner universities, both of which are located in Portugal.

During the current phase of the project, online work teams composed of students from the various universities involved (The Federal Universities of Mato Grosso do Sul and Piauí in Brazil, the Universities of Oporto and Covilha in Portugal and the University of the Basque Country in Spain) have been required to carry out joint multimedia assignments. The collaborative framework and content of the initiative has been based on the classroom experience and research of a pro-active team of professors with a firm commitment to the field of Web journalism based in three different countries: Juliana Fernandes Teixeira and Gerson Luis Santos (Brazil), Joao Canavilhas and Fernando Zamith (Portugal) and Koldo Meso, Jesús Ángel Pérez and Ainara Larrondo (Spain).

This project, which seeks to give students a more active role in their individual learning processes and academic development, has been designed to take the high engagement levels of digital natives into account. Like other programmes of this type, it uses internationalisation at home strategies (which in this case take the form of joint Web-based reporting assignments) that foster bilingualism (the working language selected for phase two being English), to bring students into contact with peers in other countries and allow them to hone their online collaboration skills. Other facets of the programme such as virtual and classroom peer critique sessions and the exposure of Web-based class projects to a broader online audience encourage students to learn from the opinions of others and become better listeners, habits that will serve them well in their future careers as online journalists.

4. Final remarks

Studies conducted to date on the impact of media convergence indicate that most news enterprises and organisations, regardless of their size and other characteristics, continue to suffer setbacks related to the difficulty of shifting from a single media to a multimedia work culture. This evidence of their lingering inability to fully adapt to new modes of production underscores the need for a deeper examination of the professional challenges multimedia and multiplatform content production entails and how these problems might be addressed through new approaches to journalism training.

Teaching students how to create content in the traditional story formats of journalism (news, feature, interpretative, etc.) has long been the thrust of university news writing courses. Online Newswriting, the Web journalism course offered at the University of the Basque Country highlighted in this paper, was structured along these lines until quite recently. Research findings and industry feedback nevertheless indicate that this narrow approach falls short of the mark in the age of Internet technology. Young people aspiring to forge careers as news professionals must acquire other generic and cross-disciplinary competences as well in order to thrive in Journalism 2.0 and media convergent environments in which they will be called upon to demonstrate the teamworking skills required in online and offline collaboration and the production of transmedia content.

Due to the pace of technological innovation in their area of specialisation and the wide variety of formats in which they work, online media journalists are under greater pressure than their peers in print and audiovisual media to be cross-disciplinary multi-taskers and efficient team workers – roles of particular importance in the production of multimedia content.

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How to motivate students to learn Metabolic Biochemistry in a Biomedical Sciences curricula

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Abstract

Teaching methodologies used in biochemistry classes at the University level are traditionally dependent on theorical classes. The assessment is usually based on written tests performed at the end of the semester. However, most students who learn metabolism by this traditional method consider the study of metabolic biochemistry a terrifying and unforgettable experience. Understanding biochemical metabolic pathways was the proposed goal of the Medical Biochemistry curricular unit. To this end, the multi-method active learning approach was used in order to increase students' motivation towards the learning process and to allow the development of skills associated with group conflict resolution, critical thinking and communication skills. Overall, students and learning facilitators were highly motivated by the diversity of learning activities, particularly due to the emphasis on correlating theoretical knowledge with human health and disease. As a quality control exercise, the students were asked to answer a questionnaire on their evaluation of the teaching/learning experience. Thus, the initial analysis of the student's perception questionnaires permits to conclude that the approach undertaken yields results that surpass the traditional teaching methods. Investing in preparing attractive and motivating classes increases students and teacher's general satisfaction and the learning/teaching process becomes more efficient.

Keywords: multi-method active learning approach; Metabolic biochemistry; student´s motivation

1. Introduction

Metabolism learning at the University level is traditionally dependent on theoretical classes. Usually, biochemical metabolic pathways are presented through lectures and the assessment is usually based on written tests performed at the end of the semester. Indeed, most students who learn metabolism by this traditional method consider the experience unforgettable and terrifying and do not understand the purpose of memorizing so many pathways and chemical structures.

Understanding metabolic pathways was the proposed goal of the Medical Biochemistry curricular unit (MBCU) in the Biomedical Sciences bachelor's degree at the University of Aveiro. For that, a multi-method active learning approach (MALA) (Fardilha, Schrader, da Cruz e Silva, & da Cruz e Silva, 2010) was used in order to increase students' motivation towards the metabolic biochemistry learning process. Active learning approaches have been developed in higher education to improve the educational experience and outcomes in opposition to the traditional methods (Bate, Hommes, Duvivier, & Taylor, 2014; Bonwell & Eison, 1991; Norman & Schmidt, 1992). In this approach, students are confronted with a variety of learning strategies allowing the development of skills associated with group conflict resolution, critical thinking and oral and written communication skills, where each person learns in its own way. Here students discover, research, process and apply information, and play a pivotal role on planning, monitoring and evaluating the educational method.

The MALA approach was previously applied in the Health Sciences Department at the University of Aveiro, in the MBCU (Fardilha, Schrader, da Cruz e Silva, & da Cruz e Silva, 2010) and in the Pharmaceutical Drug Development curricular unit (Herdeiro, Teixeira Rodrigues, Ferreira, da Cruz e Silva, & Fardilha, 2014). Authors of these studies concluded that MALA approach increased the research autonomy, synthesis, integration, student assessment and discussion of knowledge. Thus, the main goal of this study was the implementation of novel MALA strategies in the MBCU to achieve higher teachers' and students' motivation towards the learning experience and to improve students' educational outcomes.

2. Methods and Results

Given the complexity of the subject matter in the MBCU, various active learning activities were integrated (Table 1). Theorical classes were included to present the basis of metabolic biochemistry, in a strategy called "Teacher-centered learning". During these expository classes, students were encouraged to interact with the teacher by asking questions and after each class students were assessed by mini-questionnaires. These mini-questionnaires

comprised several multiple-choice questions related to the topics exposed during the theorical classes.

Table 1. Learning approaches, skills developed, and assessment.

Learning activity	Learning approaches	Skills developed	Assessment (%)
1. Theorical classes	Teacher-centered learning	Listening; information access; reflection; discussion; analysis; synthesis.	Mini-questionnaires (5%); final written exam (60%).
2. Project development	Learning by teaching	Critical thinking; oral and written communication skills; capacity to explore; group conflict resolution.	Poster: abstract (5%), oral presentation (10%) and written poster (20%); Clinical cases: oral presentation.

Further, students were organized into small groups and asked to develop a poster on different subjects of the biochemical metabolism. Teachers and learning facilitators followed the project development by setting specific goals and activities with deadlines (abstract, objectives, written poster and poster oral presentation). Students were asked to first present the abstract and the objectives of the poster and an open discussion permitted clarification of students' doubts and problems encountered. Some weeks later, the posters were orally presented to the rest of class. Both activities were evaluated by teachers and learning facilitators. Teachers monitored each phase of the projects and maintained an open line of communication with the students. Given that various posters were presented to the whole class, this ensure that all students had the opportunity to learn and acquire relevant skills and knowledge. In particular, students were able to give feedback to their colleagues and to receive feedback from the teacher and peers. Posters were after presented in a conference organized by the Chemical Department of the University of Aveiro, called 10th Biochemistry Day.

In a third learning activity, students, working in groups, were requested to solve and orally present clinical cases based on metabolic biochemistry disorders. Given that all the projects were presented to the class, this ensured that all students had the opportunity to learn all the subject matter and acquire relevant knowledge.

These strategies (poster and clinical cases) are called "learning by teaching" and allows students to teach new contents to each other, being accurately guided by teachers. Although

the clinical cases activity was not included in the assessment, students were highly committed to do their best and, the resulting oral presentations were very good. The teacher and colleagues gave on time feedback on the students´ presentations which seemed to be very helpful and appreciated.

Students' performance was assessed in different moments and using different assessment strategies: oral presentation of poster and clinical cases, mini-questionnaires after each expository class and a final test. Written material was routinely submitted for assessment, including the abstract and the poster. Communication skills were also practiced and evaluated during the oral presentations. Moreover, students were submitted to a final exam, which typically comprises answers in essay format spanning and integrating the metabolic biochemistry. Thus, student assessment was a continuous process involving students themselves. Together, all tasks applied in the MBCU allowed students to develop skills associated with critical thinking, information access, reflection, group conflict resolution, as well as oral and written communication skills.

As a quality control exercise, after the end of the curricular unit, students answered a questionnaire classifying the teaching/learning experience (Figure 1). Each topic to be assessed by the student on the questionnaire included several questions related to that issue, rated on a Likert (1–5) scale. Answers of "1" indicate the most negative response (unsatisfying), while "5" the most positive (excellent). The sum of the ratings for each question (1 to 5) was transformed into a percentage of the theoretical maximum. The results presented are the mean of the percentages for all the students. From the 30 students that participate in the MBCU in the curricular year 2017/2018, 20% (n=6) did not answer the questionnaires. Results showed that the majority of the students were highly motivated due to the great diversity of the learning activities and considered that MALA is highly relevant for their curricula.
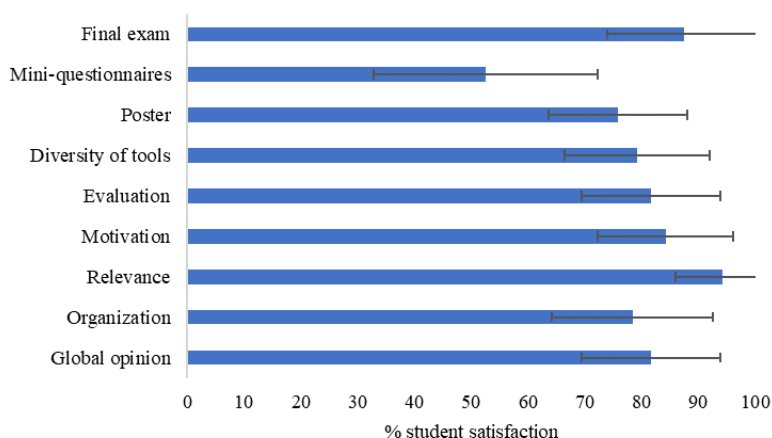
Figure 1. Results of the end of year questionnaire - based assessment of student satisfaction with their learning experience in the Medical Biochemistry unit.

Additionally, students were asked to indicate two positive and two aspects that could be improved in the MBCU. In general, they indicated that poster development and presentation was an excellent experience, in particular given that the poster had the purpose of being submitted to a conference.

The most negative aspect referred were the mini-questionnaires. Students point out that mini-questionnaires at the end of each theoretical class is very stressful. They suggest that the mini-questionnaires should be given at the beginning of the following theoretical class giving that time to consolidate the contents.

3. Conclusion

In the MBCU, a number of active learning techniques was incorporated to improve students' learning and motivation. The analysis of the student's perception questionnaires allows us to conclude that the MALA undertaken yields results that surpass the traditional teaching methods. Investing in preparing attractive and motivating classes increases students and teacher's general satisfaction and the learning/teaching process becomes more efficient. The positive results presented should encourage others in a similar situation to follow this approach.

Acknowledgments

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Toward a Future-Ready Talent Framework for Co-operative and Work-Integrated Learning

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Abstract

Co-operative education (co-op) and work-integrated learning (WIL) are powerful means to prepare post-secondary students for the VUCA world: a world that is volatile, uncertain, complex, and ambiguous. Co-op and WIL programs expose students to the workplace which, among other things, allows students to learn about the contexts and challenges facing their employers. This contributes to the development of an "adaptive resilience" that is so crucial for coping with VUCA and the future of work and learning. Still, existing co-op and WIL programs can do more. We developed a Future-Ready Talent Framework that provides educators with explicit learning outcomes, gives students clear expectations, and equips organizations with a common language with which to interact with post-secondary institutions, educators, and students. Our Framework is comprised of four different skill sets: Expand Expertise, Develop Self, Build Relationships, and Design & Deliver Solutions. Each of the four skill sets includes three distinct skills. Although it is a work in progress, our Framework can serve as the basis for improved curriculum, communication, and evaluation, and can serve as a tool for students to develop the confidence and know-how to face the future of work and learning.

Keywords: *talent; skills; co-operative education; work-integrated learning; framework; VUCA.*

1. Introduction

We live on a planet rife with significant present and future challenges. These include climate change, globalization, technological advancements and disruption, shifting economic and political landscapes, aging populations, and social and economic divides. These conditions have created what can be called a "VUCA" world: Volatile, Uncertain, Complex, and Ambiguous (Ajith, 2015).

VUCA has a direct effect on the future of work and learning. Workplaces are shifting to the "Fourth Industrial Revolution," or "Industry 4.0" (Schwab, 2017) which is characterized by the implementation of artificial intelligence, automation, and robots. As a result, jobs, roles, and recruitment strategies are being redefined. Employees now more than ever need frequent upskilling or re-skilling, placing an increasing emphasis on lifelong learning. There is also a proliferation of contract work (i.e., the "gig economy") and a decline in standard careers (Royal Bank of Canada, 2018); people cannot expect to remain in a position or with an organization for the total of their working life. Indeed, successful workers are workers who have the skills to cope with VUCA.

Co-operative education (co-op) and work-integrated learning (WIL) programs offered by post-secondary institutions are powerful means to prepare students for the VUCA world. In Canada, WIL is defined as:

> a model and process of curricular experiential education which formally and intentionally integrates a student's academic studies within a workplace or practice setting. WIL experiences include an engaged partnership of at least: an academic institution, a host organization, and a student. WIL can occur at the course or program level and includes the development of learning outcomes related to employability, personal agency, and lifelong learning. (Co-operative Education and Work-Integrated Learning Canada [CEWIL], 2019, p. 1)

CEWIL defines nine types of WIL. Co-op is one form of WIL in which students alternate between academic terms and paid work terms. Sometimes students complete several co-op work terms back-to-back. In all cases, the work terms take place in a workplace setting that is related to the student's field of study or career aspirations (CEWIL, 2019). The number of work terms a student must complete varies by program, but "the time spent in work terms must be at least 30% of the time spent in academic study for programs over 2 years in length and 25% of the time for programs 2 years and shorter in length" (CEWIL, 2019).

Our institution hosts over 120 accredited co-op programs across campus, with over 20,000 undergraduate students participating annually over 3 semesters, and a network of 6,900 employers (University of Waterloo, 2019). Our co-op and WIL programs incorporate the elements of quality WIL programming (McRae & Johnston, 2016; McRae et al., 2018) by

exposing students to multiple workplace experiences; providing pedagogical supports before, during, and after each experience; requiring feedback from their employers in the form of a workplace assessment; and requiring the completion of reflective exercises as part of their work term report. Through this process students learn about the contexts and challenges facing their employers, which contributes to the development of an "adaptive resilience" that is so crucial for coping with VUCA and the future of work and learning.

Still, there is potential to further leverage our institution's co-op and WIL opportunities to more directly address VUCA and make our students more future-ready. For one, we can strengthen the integration between and among students' workplace experiences and their degree programs. We can also help students make further sense of these experiences, while highlighting their future-ready capabilities and the role that WIL experiences have played in developing these. Doing so will give them the confidence and know-how to compete for and create new types of jobs and roles, the habits of mind for lifelong learning, and provide them the clarity of purpose in their academic, personal, and professional lives required to apply their talents to the world's needs.

The challenge of effecting such changes in a higher education setting is that it requires not only new educational programming and resources, but also a clear vision. We propose that a Future-Ready Talent Framework will provide just that. It will also provide educators with explicit learning outcomes, give students clear expectations, and equip organizations with a common language with which to interact with post-secondary institutions, educators, and students. As such, the framework will serve as the basis for improved curriculum, communication, and evaluation. This paper presents the work that has been completed on our framework thus far.

2. Methodology

A search of the academic and grey literature was conducted for existing skills and competency frameworks that focused on employment and/or post-secondary education. A final sample of 19 frameworks was identified. A mapping exercise was undertaken whereby the skills and competencies included in all 19 frameworks were listed, overlap was analyzed, and a synthesized framework was created. Expert stakeholders in co-op, career development, and WIL at our institution provided feedback on the new framework. This feedback was incorporated to produce a refined framework.

3. Results

A list of 57 skills was obtained from the 19 frameworks included in our analysis. Of the 57 skills, 15 of them occurred in at least half of the 19 frameworks. This list of 15 skills was

reduced to 12 after combining some of the skills (for example, the skills of reading and writing were subsumed under the skill of communication).

The 12 skills that are included in our framework can be grouped into four different "skill sets," as shown in Figure 1: Expand Expertise, Develop Self, Build Relationships, and Design & Deliver Solutions. When students are equipped with these skill sets, they have what we term "Future-Ready Talent." This refers to talent that makes students qualified for job opportunities that will be in demand in the future.

Expand Expertise	+	Develop Self	+	Build Relationships	+	Design & Deliver Solutions	=	**Future-Ready Talent**
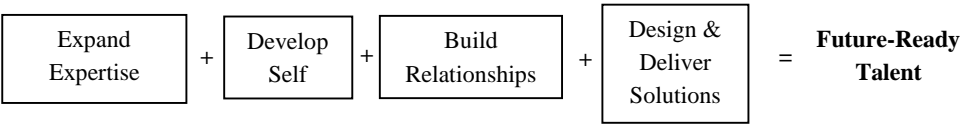
Figure 1. Skill sets that lead to future-ready graduates.

Each skill set depicted in Figure 1 contains three skills, which are listed in Table 1 and outlined below.

Table 1. The Waterloo Future-Ready Talent Framework

Expand Expertise	Develop Self	Build Relationships	Design & Deliver Solutions
information & data literacy	self-assessment	communication	critical thinking
technological literacy	self-management	collaboration	innovation mindset
context specific knowledge & skills	continuous learning & career development	cross-cultural agility	implementation

3.1. Expand Expertise

Expand Expertise refers to field-specific skills gained from a student's academic program as well as workplace and extra-curricular experiences. These skills might also be acquired through a student's self-directed learning (e.g., voluntary enrolment in online skills courses). The inclusion of this skill set in our framework is consistent with previous research (Pretti &

Drewery, 2018) which found that employers are looking for students who have, among other things, technical skills and previous work experience.

In our framework, information & data literacy pertains to the ability to critically identify and assess the quality and relevance of both quantitative and qualitative data; to organize and synthesize data from multiple sources into meaningful information; and translate information for various audiences., Technological literacy refers to embracing the use of new technologies; evaluating the strengths and limitations of possible technologies; applying technology to increase efficiency and achieve better results; and advocating for innovative technologies, including teaching others. Finally, context-specific knowledge & skills involves understanding and acknowledging the limits of one's own knowledge, skills, and abilities; developing knowledge and skills relevant to one's specific work situation; and demonstrating curiosity for the workplace context.

3.2. Develop Self

The ability to develop one's self is essential to success. Successful workers are those who continually develop and improve themselves. They have a clear sense of self (including priorities and goals), skills that help them overcome obstacles, and a tendency to improve or "up-skill" with each experience. There are three component abilities that comprise Develop Self: self-assessment, self-management, and continuous learning & career development. Self-assessment is the ability to seek out feedback from others; reflect upon one's performance; incorporate feedback and personal reflections into performance; learn from one's mistakes; and acknowledge personal areas of weakness. Self-management requires managing and regulating one's emotions; respecting one's own and others' boundaries between work and other domains of life, and adapting to the workplace culture. Continuous learning & career management involves setting goals to further their development; documenting growth and accomplishments; seeking experiences that allow them to test what they excel at and enjoy; approaching day-to-day challenges as opportunities to learn and grow; and exploring career opportunities actively, including through maintaining two-way professional relationships based on shared interests/goals.

Continuous learning overlaps with the concept of "lifelong learning," which involves an internalized love of learning, critical thinking about one's own learning, resilience in the face of learning challenges, and self-direction (Drewery et al., 2017). In previous research (Pretti & Drewery, 2018), lifelong learning was one of the "talents" that employers reported they look for in candidates during the recruitment process.

3.3. Build Relationships

We live in a social world and we need to work with others to solve problems and to succeed in our personal endeavors. There are three components to successfully building relationships:

communication, collaboration, and cross-cultural agility. Communication involves the ability to use clear and concise language; to listen to and ask questions of others to gain perspective; to adapt one's communication style and tone to the audience and circumstance; and to demonstrate respectful written, verbal, and non-verbal communication. Collaboration requires recognizing the value of diverse perspectives; actively listening to others, including demonstrating interest through verbal and non-verbal behaviours; taking responsibility for one's own actions; giving credit to others and noticing their ideas, strengths, and contributions; participating as an active member of the team; and doing a fair share of the team's work. Cross-cultural agility means using language that is inclusive of diverse groups; taking steps to learn about the values and norms present within the workplace; acknowledging and respecting multiple points of view within workplace settings; and adapting to the organization's cultural dynamics.

3.4. Design & Deliver Solutions

Problem solving is at the heart of the workplace. In order to create solutions, one must be able to think critically. This involves seeking to understand the "big picture," root problem, or purpose for one's actions. It also includes identifying multiple possible options or solutions to the problem, applying criteria to determine the best course of action, and making evidence-based decisions and/or recommendations. An innovation mindset refers to the ability to identify important problems and areas for improvement; actively integrating ideas from across contexts; demonstrating curiosity, including asking relevant questions about important issues; exploring implications of proposed solutions; and taking measured risks. Finally, implementation means managing one's own deadlines; demonstrating a commitment to goals; identifying concrete steps necessary to complete projects; tracking progress towards defined goals; and organizing and aligning one's work plan with overarching goals. Worth noting is that an innovation mindset has been identified as uniquely human; robots or automation cannot display this skill (Aoun, 2017).

4. Discussion

In this study we gathered a large number of skills and competency frameworks, mapped their components, and synthesized the data into one framework. This process of comparison and selection of skills from pre-existing frameworks necessarily results in our final framework containing skills that have been identified before. Given that, it may appear at first glance that our framework offers "nothing new" in terms of what skills are required in the workplace. However, we argue that certain skills are timeless. This "timelessness" of particular skills stems from the fact that regardless of how automated the workplace becomes, people are what matter (Aoun, 2017). Communication, for example, will always be needed. Critical thinking is always in demand because computers and robots cannot solve all of our problems.

They are incapable of human levels of creativity and divergent thinking (Aoun, 2017, Royal Bank of Canada, 2018). Other skills, such as cross-cultural agility, are more "future-focused," as they have been emphasized more recently as being necessary for success at work. For cross-cultural agility in particular, this is due to the growing trends of globalization and workers holding numerous jobs across various work cultures over the duration of their career. As another example, implementation has also been emphasized in our framework due to a labour market that is increasingly dominated by projects, contracts, and "portfolio careers." Thus, by consulting existing frameworks with an eye to the future, our resulting framework necessarily comprises a blend of both old and new.

Co-op and WIL programs provide students opportunities they might not otherwise have to develop the skills featured in the Waterloo Future-Ready Talent Framework. Workplace experiences allow students to see these skills, and to put these skills, into action. The combination of workplace experiences and the framework as a tool for reflecting upon those experiences, will allow students to "hit the ground running" as they enter the world of work.

Our framework is a work-in-progress. Next steps include validating the framework through consulting stakeholder groups, administering surveys, and using statistical methods.

There are several ways we envision the framework being used to guide WIL programming at our institution, ultimately preparing students to be successful in the VUCA world. For students, all those who participate in co-op and WIL at Waterloo will be introduced to, trained and assessed on, and encouraged to reflect on these talents. Ultimately, this will lead to an enhanced learning experience, providing students improved awareness of the skills they can develop through co-op and WIL and assisting their ability to identify, articulate and demonstrate their value vis-à-vis these future skills. For faculties, the framework can facilitate increased awareness of the role WIL plays in developing students' skills and it can guide them with data collection for program reviews and curriculum renewal. They can also use the framework as a tool to improve integration of course content with workplace contexts. For employers, the Future-Ready Talent Framework can provide clarity for crafting job descriptions and supervisory practices for co-op positions that will ensure a better fit between students and roles at their organization and student mentorship overall. Finally, at an institutional level, the framework will allow the University of Waterloo to aggregate outcomes and demonstrate impact of co-operative education and WIL, all the while engaging in a continuous improvement process.

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B-SMART: A university-industry teaching innovation project

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Abstract

The present work aims at presenting a teaching innovation project, the B-SMART, which has been implemented at UIC Barcelona in the academic year 2018/19. Conceived as a project to respond to social demands, the B-SMART project aims at creating a collaborative environment and at strengthening the ties between companies (mainly targeted to SMEs, start-ups and NGOs) and the university. To do so, students work on real challenges or projects posed by companies. This approach helps students to better understand the theoretical concepts taught in class as well as to boost soft skills that will be required in their daily practice. In turn, companies gain access to new talent (students), fresh ideas, and the knowledge and infrastructures available at the university. In this study we explain the project and pay special attention to the first two projects solved through the B-SMART project. We use design thinking as the teaching method. Preliminary results show that both students and companies benefit from this experience.

Keywords: University-industry collaboration; project-based learning; design thinking; skills acquisition.

1. Introduction

B-SMART (which stands for Be Socially-engaged, Motivated, Agile, Resolute and Talented) is a project developed by a group of lecturers from the Faculty of Economics and Social Sciences at the Universitat Internacional de Catalunya (UIC Barcelona). It is funded by the Fundació Puig and the Aula d'Innovació Docent UIC Barcelona. The project aims at creating a collaborative environment and at strengthening the ties between companies (mainly targeted to SMEs, start-ups and NGOs) and the university. In this way, the *B-SMART* project follows the line indicated by several academic studies, which claim the need to link university learning to professional reality, making the educational process a professional and personal experience (Bennett, Dunne, & Carre, 1999). These calls for a greater connection between higher education institutions and industry have led to a paradigm shift in teaching methodologies, streamlining content while promoting its application in a real environment and boosting the development of students' skills (McCabe, & O'Connor, 2014).

In this context, the idea behind the *B-SMART* project is to have students working on real-world projects (real challenges posed by companies) in order to help them better understand the theoretical concepts taught in class (hard skills) as well as to enhance some soft skills (e.g. entrepreneurship, creativity and innovation, critical thinking and team working), thus facilitating a lifelong learning (Star, & Hammer, 2008). In turn, companies gain access to new talent (students), fresh ideas, and the knowledge and infrastructures available at the university.

These projects or challenges are introduced in the syllabus of different courses in the Bachelor's Degree in Business Administration, according to the topic to be developed (e.g. human resouces, operations management, marketing, etc.). Such projects are conceived as compulsory activities, meaning that in order to pass a subject students should work on these projects. The solution to the project/challenge is evaluated both by the instructor of the course and the company. Each project might have a different length (according to the complexity of the problem to be solved).

The original value of the *B-SMART* project can be summarised in the following points:

- It promotes university-industry collaborations.
- It is based on real projects.
- It includes a social aspect, helping SMEs, NGOs and start-ups.
- It is a multidisciplinary and transversal project, involving several subjects and lecturers from different disciplines.
- It is transferable to other programs.

Therefore, the B-SMART project is expected to bring the advantages listed in Table 1:

Table 1. Advantages of the B-SMART project

Actors	Advantages
Companies (SMEs and start-ups) and NGOs	Get support to respond to existing problems or develop new lines of products, hire new talent, and get free access to qualified workforce (students and teaching staff)
Students	Apply the concepts taught in class in real cases, learn how companies operate and evolve, work with professionals, and develop soft skills
Lecturers	Obtain real content for their classes, receive training in active learning methodologies, and develop skills
Facilitators of the project (Fundació Puig and Aula d'Innovació Docent UIC Barcelona)	Gain visibility and position themselves as facilitators of university-industry collaborations

Own source (2018).

2. Teaching method

For the development of the *B-SMART* project, and being coherent with its innovative spirit, its implementation in the classroom is based on an active learning methodology that provides dynamism, facilitates the generation of ideas and is appropriate for the university environment: design thinking.

In the current business environment, design thinking is emerging as one of the most useful tools to promote creativity, innovation and entrepreneurship. Specifically, this methodology focuses on people as developers of innovation. In this sense, it offers a lens through which to observe challenges, detect needs and, ultimately, propose solutions. In other words, the approach offered by design thinking uses the sensibility of the designer and its method of solving problems to meet people's needs in a technologically feasible and commercially viable way. This methodology has been proved to facilitate the development of ideas based on the real needs of the users, while allow companies to create products capable of playing an increasingly prominent role in the market and its competitive environment.

3. Projects

3.1. SaóPrat Association

The company

SaóPrat Association is a socio-educational, non-profit and declared of public utility entity, founded in 2004 in el Prat de Llobregat (Barcelona). Its main aim is to respond to the educational and social needs of the children, adolescents and youth in need in the area.

The challenge

SaóPrat requires a Human Resources consulting job. They have defined an organisation chart with different jobs. Now, they need someone that helps them to perfrom an analysis of the competences associated to each job position.

This case was analysed in the course of Human Resources (3rd year of the Bachelor's Degree in Business Administration at UIC Barcelona) during the first semester of the academic year 2018/19. It received the support of both the director of SaóPrat and the coordinator of the Area of Funding of Resources. The involvement of the entity was key to ensure the proper deployment of the mission of the entity (i.e. to accompany young people, children and their families).

Results obtained

Students had to prepare a report with the following information:

- Catalogue of competencies according to the needs of SaóPrat Association.
- List of competences (reduce it to 15 transversal competences).
- Definition of each competence.

For each job position, students had to propose 4-5 transversal competences. In order to assess the resolution of the challenge, creativity, the justification of the choice of competences and the methodology followed were considered. The best reports were presented to the heads of the Association.

3.2. La Casa de Carlota

The company

La Casa de Carlota is a design agency founded in 2013 in Barcelona, that includes people with intellectual disabilities in its creative team. For the past five years the company has gained a strong national and international client base and has demonstrated a positive economic evolution.

The challenge

La Casa de Carlota is facing the challenge of how to replicate, scale, and expand the business model to other countries and sectors. As true social entrepreneurs, they are not only inerested in economic scalability, but also in provoking a systemic social change, which may allow people with intellectual disabilities to integrate into society and bring value to it thanks to their unique abilities, such as lateral thinking, audacity, and empathy.

This case was analysed in the courses of Social Entrepreneurship (2nd year of the Bachelor's Degree in Business Administration at UIC Barcelona) and Entrepreneurship (4th year), during the first semester of the academic year 2018/19.

Results obtained

Students were challenged to open their minds and propose ideas on how to replicate the business model of La Casa de Carlota in a sustainable way (both economically and socially). Each group presented their ideas in the form of a report and an elevated pitch to the board of directors of the company. Students' proposals were very positively valued.

From the students' viewpoint, they really enjoyed solving the challenge and acknowledged that this activity helped them to explore their ability to innovate and to discover that by working in teams, superior ideas can be reached. Certainly, the methodology used, which presupposes working in small teams with a strict "do not judge" rule, helped them to be bolder in their ideas and enhanced the participation of all of them.

4. Conclusion

In this study we have reported the experience of the *B-SMART* project. This is a 2-year project that has started this academic course (2018/19). With this project we expect to help university students to practise their skills and apply their knowledge to solve real business problems.. In order to show how the project develops, two examples have been detailed.

So far, the results obtained are encouraging. Both companies and students find the project useful and worth. Next steps involve spreading the geographical scope of the project, involving different universities and companies from other countries. That is, having students from university A located in country X working together with students from university B located in country Y, all of them solving a project from company C located in country Z.

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Design of the UX Laboratory for the Department of Communications

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Abstract

The aim of this paper is to design a laboratory suitable for UX (User eXperience) testing. The theoretical part identifies basic problems when designing products from a customer perspective. The analytical part consists of the research of the existing UX laboratories in the world as well as the possibilities of using such a laboratory in the activities of the Department of Communications or the whole faculty. In the case of the Department of Communication, which is part of the Žilina University in Žilina, the possibilities of using UX laboratories are different, for example: improving the learning process, providing modern and interesting education, helping to create student presentations, websites and its design, work on research and scientific projects, training of marketing methods. We are discussing these options in detail in this paper. The UX Laboratory can also be used to support scientific and research tasks. In the design part, a laboratory is designed both technically and economically in the environment of the Department of Communications.

Keywords: User eXperience, laboratory design, modern education.

1. Introduction

Today's world of modern technology and its constant improvement are forcing people to think and work to exploit every opportunity to achieve the best results. Measuring User eXperience (UX) is everywhere around us. The key benefits of UX can be found mainly in marketing, product design, web design and tourism, which are subjects taught at our department in the E-commerce and management study program. The aim of this paper is to analyse and design a laboratory suitable for UX testing.

It is not so easy to make a quality product for each user. The buyer has several of his own requirements and focuses mainly on the price, design and prestige of the product at the shop. At home he looks mainly at functionality and usability (Fendrych, 2010). Jeff Johnson sees design as a creative process whose boundaries are often very narrow. Our decision about what we want to create is based on the principles of design. But in the next case, we are greatly influenced by emotions during disign activities (Mauser, 2012).

2. UX tools

There are many tools and methods for exploring user experience. We know a wide range of research methods which we have at disposal, from try and know methodsm which are based on laboratory bases, to methods based on online bases (Figure 1).
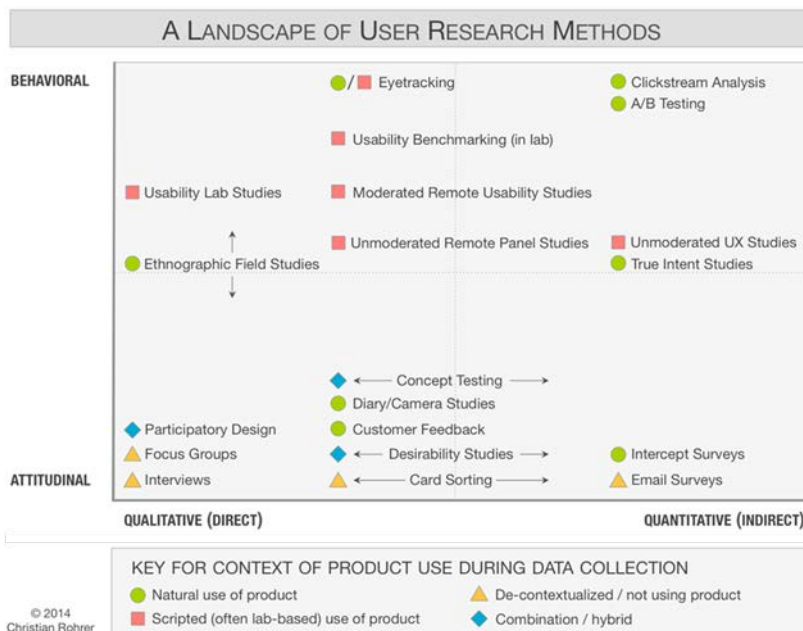

Figure 1.User research methods.

Many organizations still believe that usability testing is a luxury that requires costly laboratories and is time consuming. In fact, usability testing can be as fast as it is relatively inexpensive. Precious prototypes are not needed - papers research can also produce valuable results. Necessary participants need not to be many - even 5 users may be enough to test specific tasks. Jakob Nielsen says, that under normal circumstances, testing on five users is enough. He claims that by adding more and more users, you will learn less and less (Nielsen, 2000).

3. UX laboratories

Researchers focus on behaviour, attitudes, motivations, and emotions when using a particular product, system, or service in the UX Laboratory. Thus, UX includes the ability to measure and record user behaviour (such as efficiency, economy and learnability) and subjective experience (such as affective, meaningful, and value aspects) from human-computer interaction. Three types of rooms are usually used in UX laboratories (Capkova et al., 2013) - Test room, Observation room and Evaluation room.

As a part of research, we have been investigating laboratories in the world. Information about UX laboratories was not easy to get. Therefore, we focused our research on the UX Laboratories in Europe and we were able to get the detailed technical specifications of two UX laboratories, one from Germany and another one from Netherlands.

When working with UX, the following devices are used:

- Trackers - Pupil Labs Headset, Tobi EyeX / SteelSeries Sentry, The Eye Tribe Tracker, TOBII X2-30,
- EEG devices - MindWave (NeuroSky), Epoc (Emotive), BrainAmp Standard (Brainproducts),
- Additional Equipment of UX Laboratory - Pulse Meter, Pressure Gauge, ECG / ECG, EMG.

3.1. Possibilities of using UX laboratories

In the case of the Department of Communications, which is part of the Žilina University in Žilina, the possibilities of using UX laboratories are diverse, for example:

a. Possibility of testing students' response to study materials

Study materials could be tested to improve the quality of education at the Department of Communications (Binda, Stofkova Repkova 2017). In the case of testing students' response to study materials, it is possible to test teaching materials available to teachers in the e-learning education system. Teachers would then get the information they need to analyze student needs and their responses. They

would find out whether the students' study materials were interesting, understood, or attracted by their design. T. Bata claimed, "Our customer, our lord," which is also true in this case.

b. **Possibility of testing student work, presentations of thesis, and representative materials of the Department of Communications**

Testing designed for students to prepare different school projects. Students should be able to test audience responses to presentations intended for defence of diploma and bachelor's theses. They could create interesting and engaging presentations to defend their final work.

c. **Possibility to test the design and functionality of websites and e-commerce**

Students of the Department of Communications are studying subjects such as web design, web development, and more. Upon these learning subjects they are taught to create multimedia websites. The UX Laboratory would allow students to test their school projects web sites and e-commerce. This would improve the website's performance features, and user-friendly design. They would gain the knowledge needed to create user-oriented web sites. From these experiences with creating a user-oriented website, they could benefit from their work after graduating.

d. **Possibility to use the UX laboratory in the teaching of various subjects. Usage in the teaching of modern marketing methods and management**

The potential of the UX laboratory could be used to teach different subjects. Such a laboratory would provide teachers with new opportunities and approaches to their teaching, enabling students to be involved in the learning process or improving collaboration between teachers and their students (Madlenak et al., 2017). The benefits of the UX Laboratory would also be significant when studying new, modern marketing methods. Students would acquire knowledge based on the support of modern technologies.

e. **Possibility of using the UX laboratory for scientific purposes and for cooperation with external companies**

The added value of the UX Laboratory at the Department of Communication, would be significant in performing the scientific work of the Department. The UX laboratory could be used in research and scientific projects carried out by the department, or research projects implemented in cooperation with other organizations and universities. The number of UX laboratories in Slovakia is still lagging behind the more advanced countries. It is therefore possible to take advantage of the state of the market and to build a UX laboratory for commercial use to test web sites, e-commerce and products of these companies.

3.2. Design of the UX laboratory for the Department of Communications

The first option that was considered, was the expansion of an existing UX lab. This option has to be based on existing technical features and technologies. This may be problematic if we want to use different technologies. The application of different technologies from different companies can cause incompatibilities. We did not choose the variant of the modernization an existing laboratory or a test room because the existing device is outdated. Investing in modernization would be so inappropriate (Tothova, 2018) therefore a better solution would be to design own UX laboratory from the beginning.

Based on the analysis of existing laboratories, we have decided to solve the UX laboratory project by developing three options at a different expense. In the following sections of the paper, three variants of the UX lab design will be described at different cost. The first design of the laboratory will be based on the idea of lowering costs to a minimum. It will be a variant where only simple and inexpensive hardware devices will be used without the use of an eye tracker. In case of the second option, we will add the use of an eye tracker at lower price, than in the last third variant, which includes the use of a better quality eye tracking technology as well as biometric devices.

Detailed reports, analyzes of equipment and software as well as evaluation of analyzes can be delivered on request or presented at the conference. Because of the extent of the paper, we do not provide detailed hardware equipment for individual variants.

a. **Variant One - A simple and inexpensive UX lab**

The first variant of a simple and inexpensive UX lab is based on the fact that the cost of building the lab will be low. It will be designed for more interesting learning and testing among students and developing marketing methods and customer knowledge. We set the budget for securing laboratory components to 2500 euros. The software is required for proper functionality and communication between all devices. The software selection is adapted to keep costs at the lowest possible level. However, it is necessary to ensure the maximum functionality of all devices. We chose Zonescreen, Fraps, IOGraphica and WhatPulse. The lab is suitable for student testing, simple research tasks, tracking responses to performing tasks, and an interesting way to teach. The cost of the software equals zero. All applications required for laboratory activity are available free of charge.

b. **Variant Two - Laboratory with eye tracking technology**

After analyzing the market for available devices that support eye tracking technology, we've decided to increase the budget to an amount that will be enough to secure this technology. We have requested price offers for study and educational purposes. The decisive criterion was the price. For an investment of EUR 5000, it

is possible to provide a laboratory at a higher technical level of research. The software to ensure the laboratory is in the second variant an application pack from the Gazepoint company. The second variant - a lab with eye tracking technology - allows us to better record the responses of the test person. To obtain more accurate data, the use of eye tracking technology is crucial. For the eye tracker from Gazepoint company, we decided upon the evaluation of the technical specifications and a comparation with the concurents. The concurents provided products with a greater degree of accuracy and functionality, but did not meet the requirements for building a laboratory even with an increased budget of 6000 euros.

c. Variant three - Laboratory with eye tracking technology and biometric systems

UX laboratory based on SMI technology is available at university. Based on the price analysis of available products and the TOBII price consulting, we have decided for a budget of 20,000 euros. The price of TOBII devices is lower than the price of competing devices used in SMI's current university lab. Consultation with experts has confirmed that TOBII technology will be suitable for university use. Design of the variant three calculates with the use of biometric systems to track the body response during the testing. Brain monitoring devices (EEG), an EMG muscle tracking device, and a device monitoring ECG cardiac activity will be used. Based on the information obtained from all of these technologies in a real time, it will be possible to ensure high accuracy of measurement and the data obtained by measuring will be more accurate. It is therefore possible to get the exact data which are needed for research and scientific activity. The software equipment in this case consists of Tobii Pro Lab and EMOTIV Pure EEG. The third variant - a laboratory of the highest technological level of research from all - provides improved eye tracking technology along with the use of biometric data. The accuracy of the data obtained will thus reach the highest level of all three variants. Building a TOBII-based laboratory could have a positive impact on the research processes of the Department of Communications. It would be possible to compare the results between the TOBII laboratory and the SMI-based laboratory.

4. Conclusion

The paper can be used as an overview of possible solutions for building a UX laboratory for different conditions of use, and at different costs. It can serve as a practical guide for the implementation of a particular UX laboratory. There is not paid much attention to user testing in Slovakia. We have obtained some technical specifications of UX laboratories in

Europe, which was difficult to receive, because of their unwillingness to cooperate and provide more detailed technical specifications. Information and technical specifications for components have been obtained from the producer of the individual equipment. The next planned step of the research is to examine the possibilities of UX laboratory implementation not only at universities in Slovakia, but also in the EU, or worldwide. To do this, it will be necessary to identify differences in the academic environment between countries.

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Coordination of subjects using a real practical case to boost learning results

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Abstract

In the European Higher Education Area (EHEA) the coordination of subjects presents a challenge and a key factor for students' learning and competence development. The joint planning of subjects about fundamentals of software engineering and design and implementation of information systems in computer science higher studies provides the students a comprehensive view of the development of a real information system from the conception of the idea to the final implementation for actual users. Such coordination aims to boost learning of the specific competences as well as the generic ones, and allows to generate synergies for students to obtain a direct benefit. This paper summarizes how this experience has been designed and carried out. We describe how to implement the coordination and in addition, we include the results of a survey conducted on students enrolled in the subjects the last academic year.

Keywords: learning improvement; teaching coordination; software engineering; practical case.

1. Introduction

The current Bachelor's Degree in Computer Engineering at Universitat Jaume I, within the European Higher Education Area (EHEA), was launched in 2011. The total number of ECTS credits is 240 This degree offers four of the five sub-disciplines of computing science curricula (ACM/IEEE-CS, 2013) that can be chosen by students in the second half of the third year. All the students must acquire abilities related to the development of information systems, independently of the sub-discipline chosen. The subjects Software Engineering Fundamentals (SEF) and Design and Implementation of Information Systems (DIIS) are paramount in the learning and development of these abilities. The specific competences of both subjects1 jointly provide the necessary skills for a graduate to develop a real information system from the conception of the idea to the final implementation for actual users. Temporally, their teaching is organized in the first and second half of the third academic year, respectively, and they have some competences in common and other ones that are complementary. The common competences are: i) Analysis and synthesis skills; ii) Ability to design, develop, select and evaluate computer applications and systems and to guarantee their reliability, security and quality in accordance with ethical principles and the laws and regulations in force; and iii) Ability to design and evaluate person-computer interfaces that ensure accessibility to and usability of computer systems, services and applications. The complete set of competences is detailed in the syllabus of the courses[1].

To boost learning of these specific competences, and the generic competences as well, the faculty of these subjects collaborated to perform a joint learning, by defining a common practical case. This coordination presents a challenge and a key factor for students' learning and competences acquisition. Moreover, it provides a comprehensive view of the development of a real information system, because temporalization of subjects has a parallelism with actual projects in business. This paper summarizes how this experience has been carried out for the last five years and, in addition, we analyze information gathered from students that participated the last academic year to assess the result of this experience.

2. Design of the coordination

In this section we describe separately each subject emphasizing which are their specific learning outcomes, and what their challenges and risks are. Finally, we describe how we have designed and implemented the coordination experience as a teaching method using a practical case.

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[1] http://ujiapps.uji.es/sia/rest/publicacion/2018/estudio/225

2.1. Standpoint of Software Engineering Fundamentals

Software Engineering Fundamentals is a compulsory subject that, summarizing, includes as learning outcomes: acquiring knowledge about concepts as software engineering, computer systems, information systems, methodologies, techniques and software engineering support tools; identifying and analysing user requirements to define how a computer system can support organisations to achieve their goals; analysing and designing system processes and user interfaces; applying concepts as estimating, planning and managing software and finally writing technical documents on software engineering.

Teaching software engineering is amazing when students understand that the subject sets up the basis on which they will build the software product. But when we present the subject and the listed learning outcomes the students used to ask: where are we going to code?

In general, computer science students feel more comfortable sitting down in front of the computer for coding, debugging and testing, than talking to understand the businesses and processes, dealing with users, or developing accurate documentation and verifying and validating their proposals. They feel that this is not their job and that the methodological proposals have nothing to do with their actual job perspectives.

Therefore, to develop a strategy to make the subject of software engineering enjoyable was necessary. Furthermore, providing the coordination between a subject that mainly includes methodological concepts, with another one that puts into practice these concepts to develop a software product was a strategy that should provide better learning results.

2.2. Standpoint of Design and Implementation of Information Systems

Design and Implementation of Information Systems broadens knowledge acquired previously in the degree, related to the design of relational databases, software engineering fundamentals and the implementation of distributed systems. In this subject, students acquire knowledge about how to design, implement and evaluate user interfaces as well as the knowledge to develop web applications for access to information systems. This represents core abilities of a computer engineer, since the design and implementation of information systems has a very important role in enterprise software development.

The teaching of this subject is based mainly on two methodologies: project-based learning (PBL) (Dos Santos et al., 2009; Kay et al., 2000) and cooperative learning (CL). Through PBL the basic skills of the subject are taught by motivating students through solving a real problem, close to a real-world case that student may find in a workplace. Specifically, students undertake a project that involves the design and implementation of a web application.

Therefore, during one semester the students learn how to design a universal, usable, portable and easily to maintain web application, and at the same time all the technology needed to

implement it. The analysis and design of the information system to implement is very important knowledge and task associated to DIIS, and trying to develop this task in the same semester seemed too ambitious. Thus, the coordination with Software Engineering Fundamentals seemed very beneficial for the subject, since the students will develop these analysis and design tasks during the first semester, before this subject starts.

2.3. Coordination planning and implementation

The curricula of the EHEA Bachelor's Degree in Computer Engineering promote to coordinate subjects as a key issue to improve student learning results. Regarding the common contents, the problems detected and organizational aspects, these two subjects were considered to be good candidates for such a coordination. Next we detail the steps followed to implement the coordination.

Set up the coordination goals

In SEF it was important to motivate the students to develop the first phases of the project. Therefore to describe the project as a preliminary study of a software product could produce a positive effect and a change of attitude. In DIIS the main goal of the coordination was to start with a detailed analysis of the case already performed. Also, working in teams is important in both.

Define actions to implement the coordination.

There are several mechanisms to implement coordination for improving learning as for instance Clemmensen and Nørbjerg (2004). After studying different options we decided to use a real practical case as the guiding theme in the coordination of both subjects to provide continuity and completeness of their learning objectives. The teaching coordination was performed through the following actions:

- Define a practical case based on a real information system.

- Promote and highlight as an added value the use of a unique practical case in both subjects.

- Meetings to coordinate and track the project development.

Before the academic year starts, the faculty prepares the case description accurately in order to be understandable for students, considering that the resolution of the problem requires acquiring the abilities of the subjects but also with an equilibrated level of difficulty. The case is different and renewed every year to show novel aspects that make it more motivating for the students (Anderson and Schiano, 2014). Figure 1 shows the contents that the students develop to solve the proposal of the practical case in each subject and those that are common in both.

To employ effective strategies to enhance student motivation will provide better engagement and good effects on student performance (Liu et al, 2012; Domenech et al, 2015). During the first semester, the students apply the concepts acquired in SEF to carry out the first phases of a software engineering project which aims to develop an information system. The result is a report where they describe the objectives and goals of the product, the requirements and the analysis and a high level design of the information system. During the second semester, the students design and implement the system, beginning from the previous work. In this case, the results are a deeper design, including usability issues, and the coding of the final information system. This use of a common case provides benefits to both, students and faculty, because the effort in the comprehension of the case can be profitable during all the academic year. We need to conveniently explain this fact to increase students' awareness of the importance of doing a good job in SEF to obtain good results in DSII. If a student is not enrolled in both subjects the same academic year, she is included in a group where the basic knowledge needed about the case is guaranteed by the other team members.
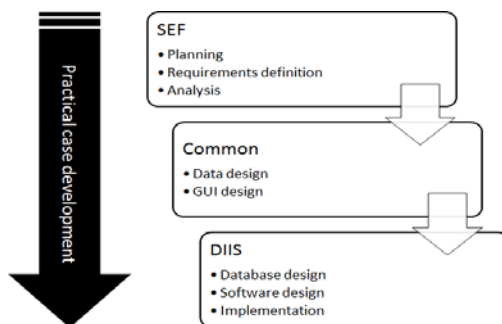
Figure 1. Subject contents of the practical case development.

The faculty develop at least three meetings to organize the coordination: the first one, at the beginning of the first semester, to review the practical case definition and setup the minimum requirements of the solution; the second one, at the end of the first semester to track the work that the students have performed, to share results, to identify changes and to establish the common basis of the design that is considered as an starting point for the second semester; a final meeting is conducted to assess the complete results of the coordination and the practical case, at the end of the academic year. These meetings aim to share results of the implementation of the project in the subjects, to identify problems and to suggest solutions.

Coordination assessment.

Each year we review the work done by the students and the problems identified. This analysis provides a feedback that is used to improve how the faculty coordinate their subjects' contents as well as to define the new practical case for the next academic year. During several academic years, we have carried out this assessment regarding the academic results and how

the students have been involved in the subject. The last year we conducted a survey to gather information from students and to assess what are the strengths and weaknesses of this coordination work. The work developed to conduct this survey is described and analyzed in the next section.

3. Survey

In order to validate whether the coordination of these two subjects provide benefits and better results we planned to develop a survey to collect information from students that had already finalized both subjects. Therefore we used a questionnaire as a primary mean and we completed the information gathering by interviewing a small group of students (Fink, 2003).

The steps we followed to develop this survey are:

- Survey goal definition and plan: to know what is the actual students' perception about the coordination, to assess whether the coordination provide acceptable results and to detect any need of improvement.

- Information gathering design: anonymous questionnaires and interviews. We defined direct questions that were easy to answer to motivate students to participate.

- Questionnaire application and interviews

- Data collection and analysis.

Next, the results of the questionnaire and the interviews are described and analyzed.

3.1. Questionnaire and Results

For gathering the students' opinion we prepared a questionnaire which was delivered to all the students enrolled in the subjects during academic year 2017-2018. The number of potential addressees are 60, answers 19; answers from students enrolled in one subject 3, and answers from students enrolled in both subjects 16.

The first question asked for the enrollment in both subjects the same academic year, with answer yes/no. Then, a number of statements were provided, together with a Likert-type scale with 5 possible responses from "strongly disagree" to "strongly agree". The students who had enrolled the subjects in different academic years where asked about the difficulty of understanding the practical case at DIIS. They all agreed that it was difficult to understand the practical case at DIIS even that the teachers provided a standard solution. One of them even strongly agreed. The other students, who had enrolled in both subjects the same academic year, were asked about their agreement or disagreement to these four statements:

- S1: The solution developed in SEF provided me a better idea of the problem to be solved in the implementation

- S2: While attending DIIS, I modified the model performed in SEF because as we progress in the case implementation I have a better understanding of the problem.

- S3: The fact of coordinating the practical case in both subjects is a positive aspect for integration of the knowledge that we acquire.

- S4: The transition from one subject to the other has been adequate.

Figure 2 shows the assessments for these four sentences. Most students agree that the solution developed in SEF provided them a better understanding of the problem during the implementation (S1). Also, most students agree that they modified the model performed in SEF due to a better understanding of the problem, but such agreement was not strong (S2). Maybe this is due to the fact that these modifications usually consist of minor changes. Nevertheless, almost three quarters of respondents agree that the coordination is positive for the integration of knowledge (S3), and most of them agree strongly. Finally, most of the students consider that the transition was adequate (S4).
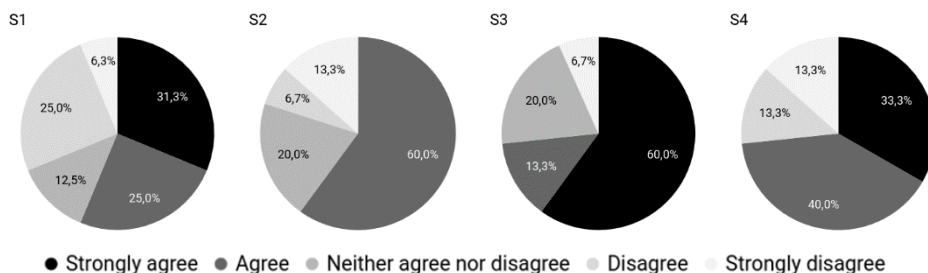
Figure 2. Degree of agreement of students that performed both subjects in one academic year, about coordination of both subjects and transition between them. The total count does not include non-respondents. Most students agree that the transition is adequate (S4), and coordination is positive (S3). Although not so strongly, most students agree that coordination helps to know better the practical case to be developed (S1 and S2).

Finally, the questionnaire included an invitation to comment issues they missed:

- M1: Did you miss any issue or topic in SEF? (Yes/no). If yes, which?

- M2: Did you miss any issue or topic in DIIS? (Yes/no). If yes, which?

Most answers were no: 100% answered no to M1, while 75% answered no to M2. All of the

25% positive answers asked for extensions of the current examples and technologies used in DIIS, but none of the answers referred to neither the coordination, nor the planning and approach of the practical case.

3.2. Summary of interviews

We planned to interview a representative small group of students in order to elicit information about aspects that can be improved in the teaching coordination. To summarize, students consider the coordination experience using a practical case as a positive aspect in the learning activities of both subjects, mainly because the effort in understanding a real case is worth when the case is used by two subjects. From these interviews we concluded some key issues that must be considered to be improved, which are the difficulty of the practical case and the organization of the student teams.

4. Discussion and conclusions

After these academic years, the faculty involved in these subjects have acquired a collaborative synergy that improves not only the teaching planning and performance, but also the student's perception of the learning contents completeness. Both subjects are complementary and this coordination helps students to acquire a complete view of a software engineering project. The survey has provided a good feedback to be taken into account to improve the teaching design, mainly when it comes to define the practical case. For next years, we will review the statements and we will foster students to participate.

The results encourage us to continue and to improve this coordination because it is a primordial tool to successfully reach the learning outcomes defined in both subjects. As future work we plan to publish a solved real case for showing the complete process of developing a web based information system, starting by the requirements collection of the case and finishing with the user interface evaluation of the resulting system.

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The Importance of Intercultural and Communicative Competences for Tourism Labour Market

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Abstract

The present paper is founded on two pillars. Firstly, it is one of the current trends in education worldwide, i.e. to connect theory and practice. Secondly, it is the need to be interculturally competent speakers of a foreign language in today's globalized world of massive migration flows and signs of increasing ethnocentrism. Based upon these two requirements, the ability to communicate in a FL effectively and interculturally appropriately in the tourism industry is a must, since being employed in whichever of its sectors means encountering other cultures on a daily basis. Therefore, the aim of the present study was to find out undergraduate tourism students' opinion on the importance of intercultural communicative competences for their future profession as well as their self-assessment in the given field. The findings of the research, which are to be compared to employers' needs, revealed that there is considerable difference between the respondents' views on the significance of the investigated issues and their self-esteem.

Keywords: intercultural communicative competences, competency development, tertiary education, undergraduate tourism students, questionnaire survey.

1. Introduction

As stated in the Strategic framework – Education & Training 2020 (European Commission, 2009), "in our increasingly globalised and knowledge-based economy, Europe is in need of a well-skilled workforce to compete in terms of productivity, quality, and innovation". Despite the mentioned objective, in Slovakia growing discrepancies can be detected between the demand of the labour market and the skills people acquire, what, consequently, might lead to unemployment. Therefore, "effective communication between the labour market and the education and training sector is vital" (ibid.).

The present paper is part of a research project whose aim is to find out to what extent the accredited *8.01.01 Tourism* study programme develops students' competences with regard to the needs of their future profession. In addition, a further objective of the investigation is to make recommendations to optimize the content of the given study programme in correspondence with employers' needs. The data are collected through a three-phase questionnaire survey amongst the students of the *8.01.01 Tourism* Bachelor's degree study programme, studying at Constantine the Philosopher University in Nitra in Slovakia, both before and after having completed their three-month compulsory traineeship. In addition, the results are also to be compared with the findings of the questionnaire survey carried out among the entrepreneurs of the tourism sector in Slovakia.

The 8.01.01 Tourism study programme at Constantin the Philosopher University in Nitra, Slovakia is offered by the Department of Tourism, at the Faculty of Central European Studies. The main objective of this three-year Bachelor's study programme is to provide preparation of competent experts in tourism, especially in the context of the multicultural and multinational regions of Central Europe. The study connects theoretical knowledge with practical training in the business sphere, mainly in the tourism sector, which enables students to use the acquired knowledge directly in practice. With regard to the mentioned focus on the multicultural and multinational character of the Central-European regions, special emphasis is put on language education, since in addition to world languages, such as English or German, undergraduates also have to learn one of the languages of the regions in question, i.e. Hungarian, Polish, or Czech.

Although the research project is focused on tourism students' overall competences, (from problem-solving and team-leading through managerial and interpersonal skills to revenue and yield management or controlling quality), the present study only deals with the aspects of intercultural and communicative competences.

As far as intercultural competence (IC) is concerned, according to the Common European Framework for Languages: Learning, Teaching, Assessment (Council of Europe, 200, p. 104) it is "the ability to bring the culture of origin and the foreign culture into relation with each other", as well as to be culturally sensitive and apply a range of strategies to establish and

maintain contact with the members of the target community (Byram, 1997; Risager, 2006). In addition, FL learners must also be equipped with the ability to overcome stereotypes (Byram, 1991; Hidasi, 2004).

Jong (1996) defines communicative competence (CC) as the ability to use a foreign language effectively, which in addition to knowledge of vocabulary and grammar, also comprises the knowledge of foreign culture in terms of issues that should be avoided, what topics are considered safe or how to cope with misunderstandings that might occur during intercultural interactions. Similarly, Kachru and Nelson (1996, p. 90) also understand CC in terms of appropriateness, with regard to "all facets of language, including rate of speech and level or register of lexis", hence, the ability to recognize the different types of situations is equally important (Hall, 2002). According to Saville-Troike (1996, p. 362), CC, which consists of linguistic knowledge, interaction skills and cultural knowledge, can be "broadly defined as what a speaker needs to know to communicate appropriately within a particular speech community".

The importance of IC and CC has been verbalized by many intercultural scholars (e.g. Byram, 1991; Byram, 1997; Kramsch, 1998; Malota et al., 2013; Reynolds et al., 2004; Róka et al., 2009, etc.); however, it has probably been the most concisely formulated by Liu et al. (2011, p. 26), who claim that "only by competently interacting with others who are culturally different from us can our global village survive". They also add that " intercultural skills do not come naturally; they have to be acquired through conscious learning".

In order to develop CC, undergraduates of the *8.01.01 Tourism* study programme at Constantine the Philosopher University in Nitra have been offered four courses throughout their three-year studies. English/German language 1 in the first and English/German language 2 in the second semester is provided in form of ninety-minute blocks once a week, during the twelve weeks of the semester. The syllabi are concerned with basic tourism terminology and relevant issues in the field. Similarly, students are offered a ninety-minute course of Business English/German 1 in the third semester once a week. The number of lessons is increased only in the fourth semester, since Business English/German 2 is provided once a week as a 180-minute block. Both courses of Business English/German deal with business and economy-related issues in a tourism-industry context.

As to the development of IC, students of the *8.01.01 Tourism* Bachelor's study programme are not offered any courses on intercultural communication. Hence, students can foster their intercultural skills only within the mentioned language lessons or other vocational subjects, what to a great extent depends on teachers' willingness as well as on their competences in the given field. This fact raises the question whether the structure of the offered courses and the number of the lessons per week is appropriate and satisfactory with regard to the objective

of the study programme, i.e. to provide well-prepared, competent experts for the tourism labour market.

Therefore, the aim of the present study was to investigate students' opinions on the relevance of the selected issues in terms of their future employment in the tourism industry, as well as their self-assessment in the field in question. The paper is divided into four main parts. The intorduction is followed by the research methodology, together with the research objectives and questions; in addition, the last parts contain the findings of the investigation and the conclusions.

2. The method

The **main research aim** was to learn about undergraduate tourism students' opinion on the importance of IC and CC for their future profession as well as about their self-esteem in the given field.

Based on the research objective, the following **research questions** were formulated:

1.   What percentage of the respondents considers the following items to be very important and always necessary or highly important and often necessary: a.) CC in spoken communication, b.) CC in written communication , c.) intercultural competence?

2.   What percentage of the respondents believes to be very well or completely prepared for the tourism labour market in terms of the following items: a.) CC in spoken communication, b.) CC in written communication, c.) intercultural competence?

With regard to the main aim, students' opinions were investigated through a **questionnaire survey**.

The sample consisted of 104 undergraduates of the *8.01.01 Tourism* Bachelor's study programme, studying at the Department of Tourism, Faculty of Central European Studies, Constantine the Philosopher University in Nitra, Slovakia.

The **questionnaire** with 12 questions focused on the undergraduates' overall competences, (including their work experience and extracurricular activities). However, the present study only investigated two out of the twelve questions, as follows:

Question number 1: In your opinion to what extent are the following skills and competences important with regard to your future employment in the tourism sector? Please, indicate on a scale from 1 to 5 (1 – unimportant, completely unnecessary, 2 – important to a small extent, rather unnecessary, 3 – important to an average extent, rather necessary, 4 – highly important and often necessary, necessary, 5 – very important and always necessary).

Question number 2: Self-assessment – What do you think how well you are prepared to use the given competences in your future profession? Please, indicate on a scale from 1 to 5 (1 – I am not prepared at all; 2 – I am prepared only to a very small extent; 3 – I am only partially prepared; 4 – I am well prepared; 5 – I am completely prepared).

In addition, as already aforementioned, within both questions only three out of the thirty-two items, i.e. competences were investigated, as follows:

Item number 5: Intercultural competence

Item number 7: Communicative competence in written communication

Item number 9: Communicative competence in spoken communication.

3. Results and discussion

As it can be seen in Figure No 1, according to the students' views, CC in spoken communication is the most important one of all the three competences, for it is considered by 57.69 % of the respondents as very important and always necessary and by 31.73 % as highly important and often necessary, reaching together 89.42 % agreement on the importance of this skill.
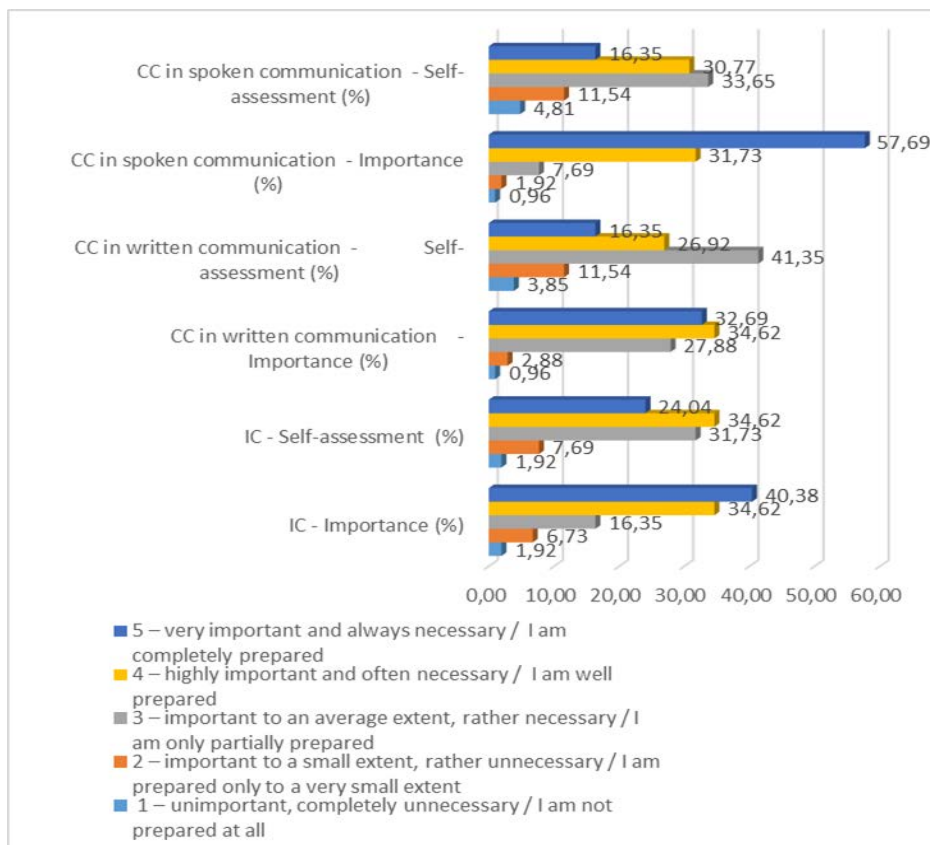
Figure 1: Students' opinion on the importance of CC and IC and their self-assessment

Furthermore, 7.69 % of the students thought that it was important to an average extent and rather necessary; and, only according to 1.92 % and 0.92 % of the students it was important to a small extent, rather unnecessary or unimportant and completely unnecessary.

On the other hand, only 16.35 % of the respondents thought that they were completely prepared and 33.77 % considered to be well prepared to speak a foreign language effectively in their future jobs, what is 50.12 % together. Moreover, 33.65 % claimed that they were only partially prepared; in addition, 11.54 % said that they were prepared only to a very small extent and 4.81 % indicated that they were not prepared at all.

As far as the CC in written communication is concerned, it seems that it is considered the least important out of the three investigated items, since it was indicated by 32.69 % of the respondents as very important and always necessary and by 34.62 % as highly important and often necessary, that is 67.31 % together. Furthermore, 27.88 % of the students thought that it was important to an average extent and rather necessary; however, similarly to the ability

to speak a WL effectively, only 2.88 % and 0.96 % considered this skill to be unimportant, completely unnecessary or important to a small extent, rather unnecessary.

In comparison with the undergraduates' self-assessment, 16.35 % thought that they were completely prepared and 26.32 % considered to be well prepared to use a foreign language effectively in written communication in their future job positions, reaching together 42.67 % agreement on the level of preparedness. In addition, 41.35 % claimed that they were partially prepared. However, 11.54 % indicated that they were prepared only to a very small extent and 3.85 % chose the option of not being prepared at all.

In terms of IC, it was perceived by 40.38 % of the respondents as very important and always necessary and by 34.62 % as highly important and often necessary, which together makes a 75 % agreement on the necessity of this skill. In addition, even though 16.35 % of the respondents thought that it was important to an average extent and rather necessary, according to 6.73 % and 1.92 % of the students, IC could be regarded as important to a small extent, rather unnecessary or even unimportant and completely unnecessary.

As to the students' self-assessment in the given field, 24.4 % claimed that they were completely prepared and 34.62 % indicated that they were well prepared to act interculturally appropriately in different situations in their future tourism positions, reaching together 59.02 % agreement on the level of preparedness. However, 31.73 % of the respondents considered to be only partially prepared; in addition, 7.69 % and 1.92 % indicated that they were prepared only to a very small extent or not prepared at all.

4. Conclusion

In order to draw conclusions, firstly, the findings of the investigation will be summarised through giving answers to the research questions.

1.   What percentage of the respondents considers the following items to be very important and always necessary or highly important and often necessary: a.) CC in spoken communication, b.) CC in written communication, c.) intercultural competence?

The examined items were considered to be very important and always necessary or highly important and often necessary by:

- a.) CC in spoken communication : 89.42 %

- b.) CC in written communication: 67.31 %

- c.) intercultural competence: 75 % of the respondents.

2.   What percentage of the respondents believes to be very well or completely prepared for the tourism labour market in terms of the following items: a.) CC in spoken communication, b.) CC in written communication, c.) intercultural competence?

47.12 % of the respondents believed that they were very well or completely prepared for the tourism labour market in terms of CC in spoken communication, while with regard to CC in written communication it was 43.27 %. In addition, in relation to IC 54.66 % of the respondents thought they were very well or completely prepared for their future profession.

In the light of the results, several conclusions can be drawn. Firstly, it is the considerable difference between the importance of the investigated items and respondents' self-assessment, especially in terms of CC in spoken communication (high importance: 89.42 % – low self-esteem: 47.12 %), but also in case of the other two investigated issues (written communication: importance – 67.31 %, self-assessment – 43.27 %; intercultural competence: importance – 75 %, self-assessment – 54.66 %). Here, the question arises as to whether the findings reflect undergraduates' lack of self-confidence or their lack of knowledge. It seems that the answer could only be given after further investigation in the field; and, a holistic view of the situation may be captured through the comparison of the present findings with the employers' responds as well as with the students' opinions after having completed their traineeship. In addition, to shed light on the reasons that lie behind the findings, it might be advisable to test undergraduates' knowledge and competences in the examined fields, i.e. their IC and CC. Yet, apparently, the data show that there is a need to support the development of the examined competences and to increase students' self-confidence in the field. Hence, in order to give them more opportunities to practice the foreign language both in written and spoken communication, it would be worth considering that the number of FL lessons per semester be increased. In addition, integrating new courses in the *8.01.01 Tourism* study programme, such as *Intercultural communication* would undoubtedly contribute to the development of undergraduates' intercultural skills.

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About Students' Abstractions
Evaluation of Items Requiring Abstract Thinking Competence

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Abstract

Abstract thinking is one of the most important competences in computer science. When starting my research, there was no complete definition of the competence nor was there a tool to assess first-semester students' competence level. Thus, I developed a competence model of abstract thinking, which allowed me to derive an assessment tool. In this work, I will present first insights gained by analyzing the tests of 134 incoming students of computer science and scientific computing. The analysis confirms the assumption that incoming students often lack in this essential competence. Moreover, the overemphasis of the data aspect of classes in object oriented programming can be confirmed for university level education. Further investigations will follow. In the future, the insights gained can be used to develop teaching units or whole teaching concepts.

Keywords: Abstract Thinking; Assessment; Evaluation; Introductory Programming; Novice Programming; Computing Education.

1. Introduction

Literature and teaching experiences indicate that the competences of abstract, logical and analytical thinking are highly important in computer science (Dörge, 2012, Computer Engineering Curricula 2016, 2015, Society, Bourque, & Fairley, 2014). They are an essential prerequisite to acquire computing competences. Nevertheless, lecturers often observe a lack in these competences among first-semester students (Kramer, 2007, Thurner, Böttcher, & Kämper, 2014). Besides logical and analytical thinking, abstract thinking is less researched.

When looking at publications regarding the measurement of abstract thinking, like Kurtz (Kurtz, 1980) or Or-Bach & Lavy (Or-Bach & Lavy, 2004), it is noticeable that there is no definition stated the tool is based on, the tool is often not explicitly presented or the sample sizes are very small. And many times, the methods applied are not appropriate to be applied in first-semseter classes were the lack already exists, as they require experts knowledge concerning software development. When used at the beginning of students studies, I would mainly measure their professional knowledge. An approach that is appropriate for my intended setting is described by Bennedsen & Caspersen (Bennedsen & Caspersen, 2006). However, their study led to unexpected results and needs further revision. Thus, there is still a research gap. Consequently, an assessment tool called *Abstract Thinking Assessemnt (ATA)* has been developed, based on a well-research competence definition. The target group of the assessment is the population first-semester students in computer science or related topics, and thus, does not require any computer science specific knowledge.

2. Fundamentals

In order to interpret the data, it is crucial to know the definition underlying all problems (called items) in the ATA. All items are based on the competence model described in (Zehetmeier, Böttcher, Brüggemann-Klein, & Thurner, Defining the Competence of Abstract Thinking and Evaluating CS-Students' Level of Abstraction, 2019). It consists of the following three components:

- Identify commonalities in order to summarize them and to determine differences to normalize them, e.g. by parametrisation.
- Decide which information is essential for the given purpose and which is not.
- Create theoretical relationships between items or processes.

Additionally, it is important to know how students' answers to the 24 open-ended questions have been interpreted. This was done using a coding manual. It describes two independent perpectives: *correctness* and *level of abstraction*. Hence, two codes are assigned to each answer. The coding manual used is shown in Table 1. More details regarding the

development and application of the coding manual can be found in (Zehetmeier, Böttcher, Brüggemann-Klein, & Thurner, 2019).

Table 1: Coding manual for dimension correctness and level of abstraction
(Zehetmeier, Böttcher, Brüggemann-Klein, & Thurner, Defining the Competence of Abstract Thinking and Evaluating CS-Students' Level of Abstraction, 2019)**.**

	Category	Description	Score
Correctness	Empty	Empty response field	0
	Regardless	The answer is without regard to the question. Buzzword	0
	False	An answer is false, if it is deficient or partly deficient from a professional perspective.	0
	Correct	An answer is correct, if it is accurate and complete from a professional perspective.	1
Level of Abstraction	Empty	Empty response field	0
	Regardless	The answer is without regard to the question. Buzzword	0
	Concrete	The answer describes the given examples using everyday or well-known terms.	1
	Specific	The answer depicts a rule or a rule set, which can only be applied to the given examples.	2
	Generic	The answer depicts a rule or a rule set, which can be applied to the given examples and beyond that.	3

3. Analysis

Data collection took place in winter semester 2018/19 right after the beginning of students' studies using the ATA. The population that forms the basis for these analysis are 134 first-year students in the bachelor programs of computer science and scientific computing at the Munich University of applied sciences. All assessments have been coded by me. Based on these data, known hypothesis and misconception regarding abstract thinking are investigated.

3.1 Deficites in the Competence of Abstract Thinking

Thurner et al. (Thurner, Böttcher, & Kämper, 2014) report a deficit in the competence of abstract thinking among the first-year students in computer science or related topics. So far,

no tool existed to collect data and to verify this hypothesis. With help of the newly developed ATA and the data collected, the hypothesis can now be verified.

For the evaluation, the *Levels of Abstraction* have been transformed into dichotomous scores 0 and 1. Students achieved a point, if their answer is at least on a specific level. Level specific describes answers containing rules or rule sets, but can only be applied to the given examples. Answers are valued 0 if they describe an abstraction by using unspecific terms, describing the given examples or express actions step by step.

Figure 1 depicts an exploratory analysis of students' competence of abstract thinking. The x-axis depicts the percentage threshold representing the percentage of answers that needs to show abstract thinking competence. For each threshold it is evaluated how many of the students exeed the threshold. Consequently, every entry in the heatmap represents the the percentage of students exceeding the threshold.

According to commonly chosen 50% threshold, 73% of the students would exeed the threshold. This indicates a rather small deficit among the cohort. However, this analysis solely focusses on the level of abstraction and not on the correctness of the abstraction build. By including this facet the picture is a different one (see Figure 2).

x-Axis: Percentage threshold of answers that need to show the competence of abstract thinking
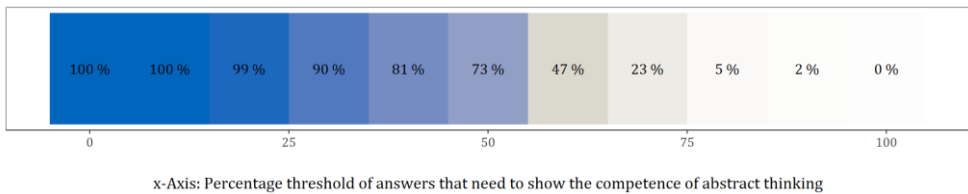
Figure 1: Development of student populations' success rate, if the threshold of answers that need to show the competence of abstract thinking is increased continuously from 0% to 100%.

x-Axis: Percentage threshold of answers that need to represent professionality
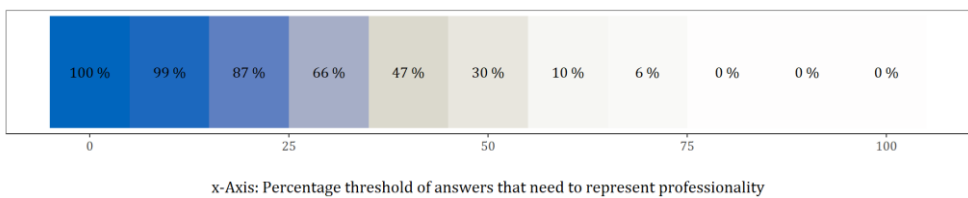
Figure 2: Development of student populations' success rate, if the threshold of answers that need to be correct and that show the competence of abstract thinking is increased continuously from 0% to 100%.

When again using the 50% threshold, only 30% of the students are able to exeed the threshold. This analysis reveals a major deficit in students' initial competence. This might be one explanation for the failure rate in the end-of-term exam, which could lead to the high drop out most computer science programs are facing with.

3.2 Misconception of Overemphasising Data Aspect of Classes

Besides hypotheses, there are known misconceptions in literature that are interesting for educational research in computer science. One that is related to abstract thinking competence is that students at school often overemphasize the data aspect of objects (Humbert, 2006). For university education it is interesting whether students at university still have this misconception as this influences how object-oriented programming is introduced.

The ATA contains two questions that allow insights into the type of characteristics students use intuitively to describe collections of similar objects. Derived from the competence model students need to describe commonalities and differences among objects and processes. For static artefacts, questions focus on summarising depictions under one umbrella term or on naming common details. Either way, students need to identify common and different characteristics.

A typical task in computer science that requires this part of the competence is the development of classes. Programmers need to find an appropriate name for the class representing several objects. Moreover, each class contains attributes and methods describing common characteristics.

Without any computer science specific knowledge students cannot write proper classes in a specific programming language, but they are able to find an umbrella term or list common characteristics of given objects. The ATA asks students to name characteristics of several instances of (1) lego bricks and (2) vehicles (two items). Their answers were categorised into five categories:

Table 2: Coding manual for answers concening the 'Vehicle-Item'.

Category	Example(s)
Missing / Regardless	*Empty,* "I don't know", Car
Component	Tires, Windows, Seats
Attribute	Colour, Weight, HP
Behaviour	Drives, consume fuel
Others	Number of Tires, Car type, Carries people

Most of these categories can be mapped to a specific programming construct, e.g. components are translated into association and behaviour is represented by methods. With this analysis I want to evaluate, which type or construct students spontaneously use to describe object. As depicted in Figure 3 students most often choose components or

attributes as characteristics. This indicates that the misconception of overemphasizing the data storage aspect of objects (Humbert, 2006) is also present in the student puopulation. Consequently, students do not focus on the dynamic aspect of objects intuitively.
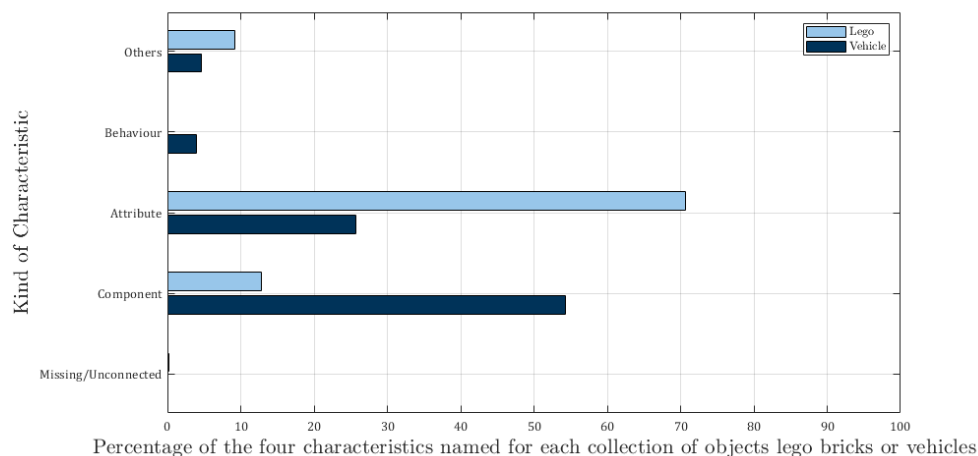

Figure 3:Percentage of the type of characteristic students used to describe several.

4. Conclusion and Future Work

The data reveals that students in computer science are not well prepared regarding their competence of abstract thinking. They are either able to describe "abstractions" (not necessarily on a high level of abstraction) correctly or they are able to specify an abstraction on a high level of abstraction, but building a correct abstraction on a high level seems challenging for them. However, such abstractions form the basis for the subsequent implementation in a specific programming language.

Thus, I agree with Or-Bach and Lavy (Or-Bach & Lavy, 2004) to discuss both, modelling and implementation in the lecture. I would suggest to put more emphasis on the modelling at the beginning of a CS-1 class, as the model is the basis for the implementation. Lectures need to put more emphasize on teaching abstract thinking competence and the processes behind, since this is one of the fundamental mental processes in the modelling phase. A useful technique to teach mental processes is cognitive apprenticeship (Collins, Brown, & Holum, 1991).

The analysis of the data also revealed that students intuitively use attributes and components to describe characteristics of similar objects. They rarely name behavioural characteristics. This finding should influence the introduction to object-oriented programming. Commonly, attributes and methods are introduced early and quickly,

whereas the topic components occur later in the curriculum and often with extensive explanations. Due to the findings, components could be taught much earlier in the curriculum as students are familiar with the concept. Lecturers should put more emphasis on teaching methods and spend more time on this topic.

Acknowledgement

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Study environment in the context of hei study quality assurance: case study at Daugavpils University (Latvia)

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Abstract

In recent years the system of higher education quality assurance has undergone several essential changes: a greater emphasis is being laid on the qualification framework, on student-centered learning and study results, the development of the teaching staff, active students' participation in the assessment of the study process. The given study is oriented towards studying students' opinions about the study environment in the context of study quality assurance at Daugavpils University (DU), Latvia.

The participants of this study were 60 students from 12 master and doctoral study programs at Daugavpils University. The analysis of structured interviews with the students made it possible to identify the typical characteristic features of HEI study environment as the significant ctireria of DU internal quality assessment. The research showed that students assess highly lecturers' personal qualities (attitude to their profession, personal interest in students' success, empathy, striving for cooperation) and their professional qualities (knowledge of the subject, didactic and communicative competence, and ability to get the feedback from students as well).

To promote the cooperation between the students and the academic staff of DU, it is useful to practice trans-disciplinary out-of-study forms, which contribute to a deeper understanding of the study content, of topicalities in global education and possibilities of synergetic thinking in cooperation with students and lecturers.

Keywords: quality assurance; higher education institution.

1. Introduction

Responding to the challenges posed by globalization, information technologies and knowledge-based economy in the 21st century, the paradigm of higher education quality assurance is undergoing changes. Quality of education is the quality of the future, determined by the role of education in regards to the future needs of individuals, community and society (Cheng & Tam, 1997). Therefore, a further quality assurance (further – QA) of a higher education institution (further – HEI) relates to the compliance of aims, content, practice and results of education with the future of new generations at solving the problems of the new millennium.

The goal of the Bologna Process is to develop the area of Europe's higher education and make it competitive, transparent and multiform by assuring a qualitative higher education which will create conditions for a sustainable social-economic development (The Bologna Declaration, 1999). The majority of studies on the system of quality management in industry and education underlines factors that promote the development of this system, for example, such as obligations of a higher level management, involvement of employees and a continuous development (Curry & Kadasah, 2002; Montes et al., 2003). Research on the quality management in higher education emphasizes the special importance of QA effectiveness (Welsh & Dey, 2002; Wiklund et al., 2003; Logermann, 2014).

Despite the fact that students' involvement into the processes of internal quality assurance of HEI is an essential factor for achieving the Bologna goals as to the quality, the studies on the issue of students' (as those concerned) integration into the procedures of internal quality assurance are very few and fragmentary (IBAR, 2013; Kohoutek, Land & Owen, 2013). Besides, little is known about students' actual situation or influence on processes of internal quality assurance to achieve a high study quality level.

Research aim: to explore DU students' opinions about the HEI study environment in the context of study quality assurance at Daugavpils University.

2. The Normative Base for the Quality Assurance at a Higher Education Institution

The main principles of European standards and guidelines for higher education are:

- good quality of higher education where the interests of students, employers and society are taken into consideration;
- institutional autonomy;
- proper external quality assurance for the goals of the institution.

After the proposal prepared and submitted by the European Association for Quality Assurance in Higher Education (ENQA), in 2005, the ministers responsible for higher education adopted Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG). In 2013, at the 24th conference "Management and Qualitative Education" the ministers of education from EU member states came to an agreement that education quality is closely related to four interrelated aims: training for a sustainable employment; getting ready for life as active citizens in a democratic society; personal development; to develop and maintain a comprehensive, progressive knowledge base via teaching, learning and studying (Council of Europe, 2013).

According to the ESG revised version adopted on May 15 – 16, 2015, at the Summit of European Ministers in Erevan (Standards and Guidelines for Quality Assurance in the European Higher Education Area, 2015), many aspects of quality assurance are being dealt with, for instance, such as a quality of academic standards, adequacy of assessment, involvement of those concerned into the management and the reliability of internal practice. This document stresses the fact that higher education institutions must have QA policy oriented towards: development of QA system; responsibility of structural units and HEI management, staff and students for QA; academic honesty and freedom; intolerance to academic deceit; struggle against lack of tolerance and discrimination of students and the staff; involvement of external interested parties in QA.

Over the time, the role of students, as those concerned internally, has been different. In between 1970 and 1990, students could be seen more frequently as members of academic community in the leading structures of HEI (Student Goteborg Declaration, 2001). HEIs compete to attract and maintain a highly qualified academic environment (Baruch, 2006). "The young generation, called generation Y (Gen Y) is highly skilled people that place high value on career development and will work for organizations that will provide them with career development opportunities" (Mayer, 2006, 65). The environment around us has an impact on students' consciousness and sub-consciousness. The quality of a study process determines the way of their thinking, habits and personality on the whole.

A comprehensive QA system ought to verify the diverse quality concepts by making use of three interrelated areas: quality of available people and material resources; quality of management and a study process; quality of outcomes (Frazer, 1994; Westerheijden & Kohoutek, 2014; IQM-HE, 2016; Ganseuer & Pistor, 2017; Martin & Parikh, 2017).

Based on the new paradigm, the concepts of added value and created value substantially differ in the context of QA. The increase in the HEI added value greatly depends on the improvement of the internal processes, while the creation of value is mainly based on the adequacy of aims and satisfaction of those concerned with the growth of education services. In HEI, the academic factors identify an important aspect of education quality. Lizzo et al.

(2002) have established that the understanding about the HEI study environment enhances the academic outcome, while the previous academic achievements do not influence it.

3. Qualities of environment for good teaching practice in HEI

How can higher education be improved? A.W. Chickering & Z.F. Gamson (1987) defined what good higher education means and formulated seven principles of good teaching, which have been intended as a guideline for HEI's academic staff, students and administrators for improving teaching and learning: 1) encourage contact between students and faculty, 2) develop reciprocity and cooperation among students, 3) encourage active learning, 4) give prompt feedback, 5) emphasize time on task, 6) communicate high expectations, 7) respect diverse talents and ways of learning.

When all principles are practiced, there are six other forces in education that surface: activity, expectations, cooperation, interaction, diversity, and responsibility.

Authors stressed qualities of environment that are favorable to good practice in higher education:

- A strong sense of shared purposes,
- Concrete support from administrators and faculty leaders for those purposes,
- Policies and procedures consistent with the purposes,
- Continuing examination of how well the purposes are being achieved.

By analyzing the concept of A.W. Chickering & Z.F. Gamson (1987) and EU normative documents in the context of study environment as one of the components of HEI's study quality assurance, authors of this paper especially emphasize the importance of such aspects of education quality as collaboration in different levels (administration - students, academic staff - students, students – students): a) active position of students in creating knowledge and compentences; b) development of students' learning motivation.

4. Research Design

Study was based on qualitative methodology which allows us to more objectively identify the QA similarities, differences and ideas about the quality of a study process and students' satisfaction with its course. The research process for this case study involved the use of structured interviews aimed at collecting data about students' position in the context of quality assurance of the study process at Daugavpils University. The data obtained during interviews of this qualitative research were analyzed according to the Tesch (1990) principles.

A total of 60 students from 12 master and doctoral study programs at Daugavpils University participated in the interviews individually. Each interview was non-structured and about 30 to 40 min long. The interview data were collected, transcribed and analyzed in 2018 according to regular qualitative coding principles (Dey, 1993). Responses from each participant were analyzed in detail and in isolation from those of other participants; there were several approaches to the analysis of these responses and the key words were identified.

The key words were classified into broader categories that might be refined and challenged until the key words classified reasonably. The major open-ended questions in the interviews were about study process quality: competences and personal qualities of academic staff, study program's content, evaluation requirements, as well as about students' participation in study quality assessment etc. A qualitative data analysis was achieved by identifying topics in the frame of research object in the collected research data, which were synthesized and generalized.

5. Results and Discussion

The analysis of interviews with the students enabled us to identify the typical characteristic features of DU study quality assessment. Students assess competences of DU academic staff in their respective areas and their favorable attitude to students as high. However, to students' mind, there could be more practical classes in some subjects. As regards to the requirements for assessing learning outcomes, students are satisfied with the fact that the assessment requirements and criteria are clear to them and academic staff are objective when assessing their knowledge, skills and competences.

When students evaluate their cooperation with academic staff, they greatly appreciate academic staff's readiness to motivate, help and support students: this encourages them to develop themselves. In regards to students' possibility to influence the study process as well as the content quality, all the informants are positive. Students state that they are active participants in assessing the study process and take part in surveys, work in study program councils and on faculty boards or openly and constructively communicate with the academic and administrative staff in this context.

This research showed that academic staff's personal qualities (attitude to their profession, taking interest in students' achievements, empathy, striving for cooperation) as well as their professional qualities (knowledge of the subject, didactic and communicative competence, and also the ability to get feedback from students) are very important for students. In this aspect, the data obtained in our research are closely analogous to the results of the research done by Arnon & Reichel (2007), who established that such academic staff's qualities as

general knowledge, orientation to a specific social mission are considered by students as less important.

What concerns the diversity of DU study environment, students of master and doctoral programs emphasize the importance of methods, which are based on concrete trans-disciplinary problem's study during group discussion and focused on sustainable development:

- "...helps to better understand the role of higher education, both globally and locally" (I.D.);
- "helps to get better around at sustainable and unsustainable activities..." (A.M.);
- "...promotes setting up of specific goals in the development of oneself as a professional" (N.D.);
- "...helps to reflexively assess the experience acquired so far and outline the broader future development opportunities" (F.D.);
- "...there is feeling of power in the discussions with others..." (S.L.);
- "...influences the creation of many new ideas..." (R.O.);
- "helps to understand the growth of oneself as professional" (D.K.);
- "...promotes productive collaboration and synergy" (U.L.);
- "..guarantees the cooperation of students and lecturers on the principles of freedom and partnership" (B.A.).

The above mentioned examples of students' responces indicate that the study environment, which is based on interactive teaching/learning methods and trans-disciplinary approach, encourages students to think about the future of civilization, sustainable and unsustainable behavior on a global and local scale, about the aims of sustainable development and awareness about them. During group discussions, participants managed to identify the possible ways for their cooperation, some complex problems and opportunities for engaging in deeper studies of these problems. In this context we can speak about the role of HEI study creative and research environment for achieving modern higher education aims.

6. Conclusions

1. Study process quality is one of the factors for the effectiveness of HEI internal quality assurance. Students' involvement in the processes of HEI internal quality assurance guarantees an adequate coordination between HEI management processes and perspective needs of society. The research data show that the personal qualities (attitude to their profession, personal interest in students' success, empathy, striving for cooperation) and professional qualification of DU academic staff (knowledge of the subject, didactic and communicative competence, and ability to get the feedback from

students as well) are one of the most important factors that influence the perception of education quality.

2. In HEI, the academic factors identify an important aspect of education quality:

- Promoting good communication between academic staff and students,
- Encouraging interaction among students,
- Providing opportunities for active participation,
- Motivating learning by communicating expectations.

3. To promote the cooperation between the students and the academic staff of DU, it is useful to practice interactive teaching/learning methods and trans-disciplinary approach, which a) contribute to a deeper understanding of the study content, b) provide opportunities for synergetic thinking in cooperation between lecturers and students, c) create a platform for generating new ideas; d) provide an opportunity for identifying oneself as a researcher in the area of interdisciplinary and trans-disciplinary problem studies.

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Promoting critical thinking in higher education in the context of teacher professional development

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Abstract

Critical thinking is profusely recognized as a key-skill for today's higher education students, who are simultaneously future employees/employers and forever local-global citizens. Yet, critical thinking must be deliberately, explicitly, and systematically promoted if it is expected to arise and expand. Such a promotion may be stimulated by teachers through the application of strategies that are oriented to critical thinking. Alas, recurrent evidence shows that teachers themselves need teacher professional development on how to do so, seeing that, as a rule, teacher education does not address the promotion of critical thinking open-handedly. With such in mind, the present paper presents a proposal of a teacher continuing professional development program consisting of five two-hour sessions, aimed at enabling university teachers to learn about critical thinking and how to think critically and, in turn, to learn how to teach their students for critical thinking. This program shall be implemented in 2019, with teachers at a public university located in the northern-central region of Portugal. Considerations are made about how the promotion of critical thinking in higher education may be performed via university teacher continuing professional development, bearing in mind the characteristics of this specific public and the principles of teacher professional development itself.

Keywords: Critical thinking; higher education; teacher professional development; university teacher continuing professional development; teacher professional development principles.

1. Introduction

Critical thinking (CT) is comprised of capacities, dispositions, knowledge, and criteria, which can be used in everyday life to think reasonably, find explanations, make decisions, and solve challenges (Franco, Vieira, & Saiz, 2017). Accordingly, it is considered a key-skill today – and tomorrow –, say international reports (e.g., OECD, 2015; UNESCO, 2015; World Bank, 2018). Given its broad relevance, which reaches college campus, work world and everyday life (Franco, Vieira, & Tenreiro-Vieira, 2018), and since there is evidence that thinking can be improved and that it is possible to develop students' CT (Halpern, 2014), one core question arises from that assertion in terms of an educational prospective analysis: How can it be done?

According to the literature (e.g., Nisbett, 2016), the quality of thinking is not a trait fixed at the outset, therefore impermeable to development. On the contrary, the quality of thinking is open to improvement, provided that CT instruction is made available (Halpern, 2014; Saiz, 2018). Notwithstanding, both the emergence and expansion of CT require one fundamental prerequisite: promotion that is deliberate, explicit, and systematic (Franco, Butler, & Halpern, 2015). CT is essential at any age and at any place, reason why it should be promoted, yet this must be done according to each individual's developmental stage. Indeed, "it is part of good teaching to know where our students are, to meet them there, and then to guide them further along the road" (Edman, 2008, p. 46). In the present paper, we shall focus on the promotion of CT that may be promoted by teachers at school, more specifically, by university professors at the higher education level. Nonetheless, in lieu of focusing on students, it is necessary to focus first on teachers (Janssen et al., 2019), since they will not teach for CT deliberately, explicitly, and systematically without previous teacher professional development.

2. Critical thinking and teacher professional development

There are specific strategies that are oriented to the promotion of CT – when implemented deliberately, explicitly, and systematically for that purpose. Using such strategies, teachers can create learning activities that shall enable students to build knowledge and to build on thinking dispositions, abilities, and criteria – the four pillars of CT – in an integrated way (Tenreiro-Vieira & Vieira, 2014). Yet, before teachers can teach for CT, they are in need of learning how to do so, if they expect to create long-term impacts. Indeed, teacher education does not address, as a rule, the promotion of CT open-handedly (Vieira & Tenreiro-Vieira, 2016). In the meanwhile, teachers may not have a clear, in-depth, precise understanding of what CT entails (Bezanilla-Albisua, Poblete-Ruiz, Fernández-Nogueira, Arranz-Turnes, & Campo-Carrasco, 2018). Thus, opportunities for teacher continuing professional development are in need, so teachers may overcome such gaps. The literature suggests that the promotion of teachers' CT is not only possible (Janssen et al., 2019), but that it is

especially effective when teachers receive such professional development opportunities (Abrami et al., 2008).

With such in mind, the present paper presents a proposal of a teacher continuing professional development program aimed at enabling university professors to learn about CT and how to think critically and, in turn, to learn how to teach their students for CT.

3. Promoting critical thinking: A proposal of a university teacher continuing professional development program

The present teacher continuing professional development program was designed in 2018, in light of successful results emphasized in the literature, and shall be implemented in 2019 with teachers at a public university located in the northern-central region of Portugal. Its main goal is to support, supervise, and share with that university's teachers teaching-learning strategies that are oriented to the deliberate, explicit, and intentional promotion of CT. In the long run, this program is aimed at creating impacts on the CT of those teachers' students.

The program includes five two-hour sessions, each one directed at particular goals. Along the program, different strategies oriented to the promotion of CT are presented and practiced – questioning, circle of knowledge, argumentation, constructive controversy, conceptual map, reflexive writing, explain thinking, decision making –, in an alternation between moments for theoretical framing and practical activities (cf. Table 1). Indeed, all activities are preceded by moments of conceptual framing, in order to enable participants to perform all the activities proposed throughout the program.

Table 1. General goals and practical activities of each session in the program.

Session	General goals	Practical activities
1	(i) To raise teachers' awareness about the promotion of CT in the classroom; (ii) To stimulate the reflection about present and possible personal pedagogical practices.	(a) In large group, participants are asked to identify the characteristics that define CT or someone who is a critical thinker. (b) Each participant is asked to name a concrete example of a situation in class in which s/he felt that students were not following or not understanding a certain content and it was necessary to shift gears. Participants are oriented to explore together what change of strategy they had to perform in such situations and its impact. (c) In groups of two people, participants are asked to identify three pedagogical strategies already used by them and which might foster the promotion of CT. In large group, participants are asked to share those strategies, when they were used, and the impact they had.

| 2 | (i) To connect CT to specific strategies for its promotion;

(ii) To provide practical opportunities for teachers to acquaint with and experience strategies oriented to the promotion of CT: questioning, circle of knowledge, argumentation, and constructive controversy. | (a) Participants are asked to watch an excerpt of the movie "Thank you for smoking" (2005, by Jason Reitman), and to identify which CT abilities and dispositions were evident in the movie, as well as which characters displayed them best. Participants are oriented to reflect on the relevance of CT in daily situations and challenges.

(b) Participants are presented a controversial topic of current social and political affairs (e.g., decriminalization of euthanasia). In small groups, participants are given a newspaper article on that topic (two groups get the same article). Each group is asked to examine their article and to answer a few questions. In large group, each group with the same article is asked to answer those questions; if there are different views on one same article, the elements of the two goups must debate and seek consensus. The elements of the other groups whose article is not yet being discussed must listen actively and contribute with information/reflexions from their article. The process restarts, this time with the other groups.

(c) Participants are divided in two groups. With reference to a controversial topic (e.g., liberalization of gun licence in the USA), each group is asked to stand in favor or against the topic, regardless of their true standing, and to search for plausible information to sustain their standing, as well as to answer a few questions to prepare their line of argument. Again in large group, each group makes a brief openning statement with arguments in favor of their standing. Following both opening statements, each group must present an argument in favor of its standing, which shall be countered by a rebuttal by the other group. At the end of the ativity, participants are asked to share their true standing on the topic, and if it was hard to stand in favor of/against something they are in fact against/in favor of. They are asked to share if the process of search for information, argumentation, and debate changed/did not change (something about) how they thought about the topic, and why. |
| 3 | (i) To connect CT to specific strategies for its promotion;

(ii) To provide practical opportunities for teachers to acquaint with and experience | (a) Participants are divided into pairs, and asked to build, in light of what they have learned so far, a concept map representing CT (namely, its definition, dimensions, and relevance).

(b) Each participant is given a card containing a quote by a national or international public leader concerning current topics (e.g., the migrants' crisis in Europe; ilegal immigration in the USA), and asked to write a brief essay on it, explaining what is that person's standing on the topic, as well as her/his own. The quote cards are collected and distributed again. Each participant must read her/his new quote, and the participant who had written the essay about that quote must |

	strategies oriented to the promotion of CT: concept map, reflexive writing, explain thinking, decision making.	read it. The participant holding the quote card must actively listen to the essay, explain in her/his own words its author's standing, and then share her/his own standing. (c) Each participant is given an article on a controversial topic of current affairs, and asked to fill in a decision-making table to come to a decision. There are two different versions of the question. After comming up with a decision individually, participants are divided into pairs (according to the same formulation of the question), and asked to complete the table once again, after a joint decision-making process. In the large group, each pair is asked to share their decision and its reasons. Also, participants are asked to explain if the decision-making process was easier/more difficult when made in pairs, and how consensus was handled. Participants are also oriented to reflect on the eventual changes in decisions made according to each formulation of the question.
4	(i) To raise teachers' awareness about the impact of personal beliefs and cognitive bias on thinking and behavior; (ii) To guide teachers in a reflection on the presence and insidious influence of persuasion techniques contained in natural language.	(a) After an activity proposed by Brian Dunning (2012, *Your brain sucks*), participants are shown how brains tend to create categories to make recovery of information stored in memory easier. (b) Participants are asked to provide examples of situations in their professional and personal lives that help to illustrate the different cognitive biases and fallacies approached in the session. (c) Examples of advertisements are distributed, and each participant is asked to examine her/his ad and to reflect if/how could it be considered misleading advertising. (d) Newspaper articles are distributed. Participants are asked to identify if their article is a fake news or not, and why they think so. After correctly identifying each article, participants are guided on a reflection about how they can assure to access precise information. (e) Participants are asked to watch an excerpt of *The Big Bang Theory* TV show, to ignite a debate around barriers to CT. (f) Participants are asked to sign a petition against dihydrogen monoxide. This activity aims to demonstrate if someone is deceived by this pseudo-scientific request to ban water.
5	(i) To support teachers to create activities using the strategies learned.	(a) Participants are divided into pairs, so they may have a "critical friend", besides the trainers, with whom to share the process of creating/adapting activities for their own classes, using the strategies oriented to CT that were learned throughout the program.

At the end of the program, participants are expected to have become prone to autonomously implement such CT friendly strategies in their own practice. At the same time, they should have become able to distinguish facts from opinions, beliefs from knowledge; to identify persuasion techniques conveyed in natural language, as well as fallacies in reasoning; to search for and consider conflicting information; to produce a clear formulation of a complex issue; to identify, analyze, evaluate, and present arguments; among many others.

The program presented here was designed broadly following the principles of teacher professional development, which serve as a set of guidelines on how teacher education and teacher continuing professional development must be delivered. Such principles recommend that teacher professional development must enclose opportunities for collaborative work, a reinforcement of pedagogical content knowledge, a symbiosis between the theoretical and practical dimensions of formation, similarity among the formation and the kind of practices that teachers shall implement themselves in their classes, besides moments for teachers to question, deconstruct, and recreate personal conceptions and practices (Vieira, Tenreiro-Vieira, & Martins, 2011).

4. Final considerations

CT is crucial for today's university students, future employees, and forever local-global citizens. Nonetheless, it must be deliberately, explicitly, and systematically promoted if it is to be developed. Strategies that are oriented to the promotion of CT should be used by teachers, and yet, this possibility is reliant on teachers' previous professional development on how to do so, which not always is accomplished. Moreover, university teachers' ability and will to teach for CT does not improve without difficulty, but rather needs to be supported by formal teacher professional development opportunities, besides further studies about which are the best ways to promote that ability and will (Janssen et al., 2019). To help fill this gap, the program presented here is a possibility on how to do such a previous work with university teachers, so they may learn about CT and how to teach for it.

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Learning Gain using a game improve pharmacology knowledge in two transnational HE institutes

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Abstract

Gamification in higher education has been shown to provide a diverse range of learning opportunities for higher education practitioners as well as students. Building on our research exploring the benefits of using a card-based, role-playing team game called "Braincept^{TM}" to aid pharmacology learning for medical students, we now test the reproducibility of our novel finding that this game leads to appreciable and sustained learning gains in medical students from two different higher education institutes. Here we present student feedback, thematic analysis and quantitative pre-and post-test data collected from students who played Braincept^{TM}. Our data shows that this style of gamified learning has a reproducible positive effect on student pharmacological knowledge as well as measurable learning gains post-game play in both cohorts of students leading us to conclude that gamification of pharmacology learning may be a pedagogically valuable transnational educational intervention.

Keywords: Gamification; pedagogy; pharmacology; learning and teaching; confidence.

1. Introduction

So called, "serious games" have been established in the last decade as having positive effects on both learner engagement and learning gain (Aynsley *et al*, 2017 and 2018). Despite these established positive impacts, the precise combination of game-based variables that lead to success are still relatively unknown within the higher education context although increasingly, employability related skills are being recognised as a critical benefit of serious game play (Dascalu *et al*, 2016; Moffat *et al*, 2015). Braincept[TM] is an educational card-based, team role-playing game that we created to aid improvement in developing pharmacology knowledge (Aynsley *et al*, 2017). In refining our approach through interactive gamification of learning, we use our game to expand students' current knowledge of and confidence with, pharmacological principles in an educational theory-informed way (Nevin et al, 2014; Iosup and Epema, 2014). Braincept[TM] allows up to 5 students to tackle a series of pharmacology-based patient scenarios as a self-directed team without needing a specialist tutor to be present, with the ultimate goal of encouraging learners to link drug names with their primary mechanism(s) of action and common side effect(s) as well as increase their confidence in handling this knowledge (Aynsley *et al*, 2017). Our aim in the present study was two-fold:

- To provide longitudinal data to test the reproducibility of our previous finding of measurable learning gain through play in an entirely different cohort of medical students within our own UK-based institute.
- To repeat this experimental design with a small cohort (8) of international medical students attending the American International Medical University and determine if measurable learning gains are reproducible in a transnational context.

The potential findings from our work addressing these aims will inform how we build upon the pedagogic and social development skills that our gamified approach to pharmacology learning, as well as proffer pilot data exploring the transferability of this approach transnationally to aid medical student education more widely.

Description of the play mechanic of Braincept[TM] has been previously described (Aynsley *et al*, 2017). Pre- and Post-gameplay, all students were asked to complete our anonymous evaluation questionnaire. This question instrument comprised a 5-point Likert scale with space for free-text comments to collect perceptual data before and after playing the game. Free-text comments were also sought to support the validity of the Likert data and to allow participants to qualify their opinions (Likert, 1932). Learning gain was assessed immediately pre- and post-game and tested again 3 days post-game, using short pharmacology quizzes consisting three different questions within a conserved format: Q1 – For a given drug what is the mechanism of action?; Q2 – For a given mechanism of action, name a drug?; Q3 – What are the main side effects of a given drug?.

2. Results
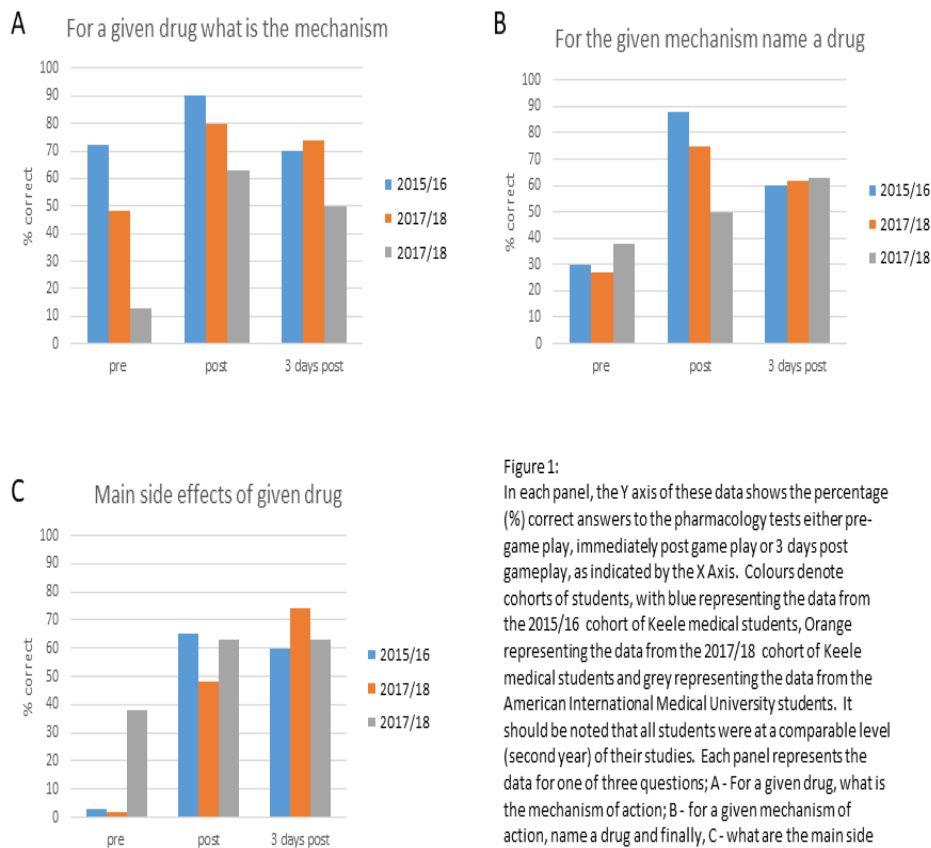
Figure 1:
In each panel, the Y axis of these data shows the percentage (%) correct answers to the pharmacology tests either pre-game play, immediately post game play or 3 days post gameplay, as indicated by the X Axis. Colours denote cohorts of students, with blue representing the data from the 2015/16 cohort of Keele medical students, Orange representing the data from the 2017/18 cohort of Keele medical students and grey representing the data from the American International Medical University students. It should be noted that all students were at a comparable level (second year) of their studies. Each panel represents the data for one of three questions; A - For a given drug, what is the mechanism of action; B - for a given mechanism of action, name a drug and finally, C - what are the main side effects of a given drug.

Figure 1. Learning Gain Data

Table 1. Free-text Data and representative comments

Area	Keele		AIMU		Example comments
	+ve	- ve	+ve	- ve	
A: Game Mechanics & Physical nature	6	1	8	0	K: Good visual way of learning
					K: Negative – Feel like the mechanism of action cards aren't as detailed as the answers required in exams
					A: Games played virtually it may be just us playing with other online people may not be so interactive. Playing physically we are interacting with others. We are getting to know other's thoughts and our mistakes. We have a scenario in front of us and a patient
					A: Mimics traditional doctor-patient consultation. Face to face. Traditional game promotes group interaction
B: Gamification of learning	14	0	4	0	K: Very fun, approach made me really think about what drug to give
					A: Concepts and knowledge stick easily to the brain
					A: I felt the game is very educative in the sense that it brings our mind back to what we have learned in Pharmacology
					A: Mistakes in front of friends, get corrected and less inhibitions than making the same mistake in front of teacher
C: Perceptions	19	0	4	0	K: Was scared to play because I know nothing! It was an excellent way of pulling out bits of knowledge in a non-intimidating way
					K: Helps to make a potentially boring subject more engaging
					A: Fun way of learning. Less stress. Remember things better

D: Game use in learning	9	0	4	0	K: Would be good if matched with drugs from the PBL cases → play each week building in new drugs.
					A: This helps to revise what we had learned in class. May be better than integration seminars because here everyone is active, talking between themselves and playing. You may need to have attended lectures and know about what you are going to play.
					A: Use it to revise what I have learned. Lectures may be long and may be difficult to fully concentrate
E: Clinical Context / Role-play	1	0	2	0	K: Really enjoyed this game! Felt like applying the pharmacology in a clinical setting in response to an actual patient/disease
					A: Does it in a clinical setting as we are not going to the hospital.. Feels like you are in front of patient and if you have a drug to prescribe you have to know what the drug does.
					A: I felt the game is very educative in the sense that it brings our mind back to what we have learned in Pharmacology. It puts us in the position of a future health professional. We are in a practical setting where we have to face the patient.

3. Discussion

Figure 1 presents the learning gain data from 2017/18 cohorts of both Keele (Orange) and AIMU students (Grey) when compared to our previous data from 2015/16 (Blue). Interestingly, we observed learning gain in each of three styles of exploratory question we asked to test pharmacology knowledge (for a given drug, what is the mechanism of action; for a given mechanism of action, name a drug; what are the main side effects of a given drug) when comparing pre- and immediately post-game play, with upward deflections observed in each case. This indicates to us that learning benefits from playing Braincept[TM] are reproducible in successive cohorts of Keele medical students, convincingly removing inter-cohort variability as a possible major confounding factor in determining the validity of

improving knowledge using a gamified approach. Data from the AIMU students also showed comparable learning gains when comparing pre- and immediately post-game play. Whilst learning gain measured immediately post-game play is a useful metric of both improvement in short term learning gain as well as engagement with our gamified approach to learning, we were also interested in testing longer term retention of knowledge to explore this context. The third cluster of bars in each of the panels (A, B and C) of Figure 1 reveal that retention of testable pharmacology knowledge three days later (with no access to the game during that time) remained higher than pre-game play percentages across all three question types and was observed in both cohorts (Keele and AIMU) of students. There remains two plausible explanations of the observed learning gains in Figure 1, namely that a single play session with Braincept[TM] is sufficient to allow synthesis/consolidation of pharmacology learning and improve longer-term retention sustained over 3 days, as evidenced in their testable scores. The alternative explanation is that students are using the game to self-evaluate learning gaps and then engaging in private study to increase their knowledge, reflected in an increased test score after 3 days. From a pedagogic standpoint, we suspect the latter is true and our free-text data would seem to support this assertion. We would therefore hypothesis that our gamified approach constitutes a transformative pedagogy, which we define as "learner understanding enhanced by the social, collaborative aspects" of playing the game, which offers Braincept[TM] players the opportunity to enhance discussion-based information handling and self-evaluation skills *via* shared understanding (Dolan *et al*, 2013). The American International Medical University (AIMU) is an offshore Caribbean medical school (OCMS) located in Saint Lucia admitting students predominantly from India, Nigeria, and other countries to the undergraduate medical (MD) program. The institution follows a traditional discipline-based curriculum though recently modifications to teaching-learning at the institution have been carried out (Shankar & Dakubo, 2018). Pharmacology is taught during the fourth semester of the MD program along with systemic pathology and physical diagnosis. At most OCMS a semester of study is of 15 weeks duration. Students complete 5 semesters of the basic sciences in Saint Lucia. Problem-based learning is not a part of the curriculum though clinical cases are used. Like other OCMS the school does not have its own clinical hospital and students do their clinical rotations at hospitals in the United States and the Caribbean (Shankar et al., 2017). There are challenges in providing clinical exposure to the students. Lectures are the predominant teaching-learning method used accounting for over 90% of curricular time though other methods have also been introduced. Despite various challenges small group sessions are conducted regularly in pharmacology with the emphasis being on teaching medical students to use essential medicines rationally (Shankar, 2018). Students are introduced to personal drug selection, patient counselling, pharmaceutical promotion and social issues in use of medicines among other topics. Some OCMS are switching to an integrated curriculum while many others still follow a traditional curriculum. Due to low faculty numbers and

other reasons, lectures continue to be the dominant method of teaching-learning. Xavier University School of Medicine in Aruba shifted to an integrated organ-system based curriculum in 2014 (Shankar, 2014). Some other OCMS are also having an integrated basic sciences curriculum. The other schools in Saint Lucia follow a traditional discipline-based curriculum. Our finding resulted in the emergence of five themes across the free-text data along with a couple of suggestions on ways to improve the game. These five themes were: *A: Game Mechanics and the physical nature of the game:* Our previous research explored perceptions of the digital vs. live-play formats applied to serious gaming and whilst we acknowledge that each mode of delivery has its own pros and cons, the feedback from our players indicated overwhelmingly positively that they values the interactive and discursive nature of the game as a way to promote interaction in small groups. *B: Gamification of Learning and C: Perceptions:* Our recent work has alluded to how critical the element of "fun" is in so-called "serious" games (Aynsley *et al*, 2018) and we were pleased to also find this to be the case for the Braincept^{TM} game, with all players positively identifying this was conducive to both easier retention of knowledge (further supported by our data in Figure 1) as well as reducing inhibitions or risk aversion by proxy of the game play mechanic, which we interpret as an inherent flexibility in using a game-based approach to support student learning preferences (Walsh, 2014). *D: Game use in learning:* Again, this theme had elements of seeing the game as a useful revision tool as well as a mechanism to enhance small group engagement, in a universally positive response from both student cohorts sharing ideas of engagement and active learning as aspects to Braincept^{TM} that they valued. What was also apparent from the feedback was that the game offered a different pedagogic style of learning, that was perceived as being a positive different from more traditional lecture or seminar-based learning modes. *E: Clinical Context / Simulation:* One minor theme to emerge from the student feedback comments was that of the authenticity and role-play aspects of the game, which were perceived to be of value, with students sharing that they liked both the urgency of the game play mechanic (ie, to treat a "patient") as well as the opportunity to role-play within a pseudo-clinical thematic game environment. This could also be of benefit as an unintended finding of playing the game, where there may be a small dimension of aiding in formation of learner professional (and in this case, clinical) identity made possible by the thematic nature of the game and our future work will look to explore this more rigorously. In conclusion, we interpret our finding from this work as convincing evidence that our gamified approach to pharmacology learning is a transferable pedagogic model of intervention that reproducibly works in a transnational context despite having different curricula.

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Cooperative learning and the use of blogs in Higher Education. An initiative oriented to promote a deeper understanding of social and ethical issues between teacher students

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Abstract

The objective of this article is to evaluate the promotion of cooperative learning through the use of blogs in several courses of sociology of education oriented towards undergraduate teacher students. Cooperative learning entails that the student interaction is continued and profound, as well as oriented to obtain a major social and ethical deep learning among students. Each group of students have to create a blog with different information useful for the course developing. Students, from the previous knowledge presented in class, have to define the task (objectives, plan, schedule and final product). Accordingly, each group have to self-manage the work to do (participation of each member, planning, revision...). We combine situations in class with teachers and also cooperative learning among students. In this sense, appears the process of shared knowledge towards cooperative learning. Evaluation questionnaires have shown a positive assessment by students. Findings show that their learning is deeper and more social and ethical, but, they pointed out the workload it entails.

Keywords: cooperative learning; blogs; innovative project.

1. Introduction

Cooperative learning through the use of blogs, as well as online teaching strategies, may have a major role in the future of teacher's apprenticeship. This centrality is explained in part by the changes in learning conditions promoted by the Internet. A growing literature deals with this issue in recent years (Alvàrez Herrero, 2018; Alventos et al., 2016; Chawinga, 2017; Ifinedo, 2107; Lee & Bonk, 2016; Molina et al.. 2016; Piña et al., 2016; Shana & Abulbdehb, 2015).

Online learning is developing rapidly in higher education. Many academics are experimenting with the building of online communities, embedding blogs, social media and wiki tools into their courses as a way of enhancing learning among students and between themselves and their academical environment. Some of literature is focused on the topic of blogs in higher education as a strategy of online learning. Alventos et al (2016) argue that those practice facilitate access to knowledge, promote a more active and reflective participation in the construction of learning, amplify the social experience of learning, and provide evidence on the progress of students that help to reorient the teaching-learning process stimulating critical judgment. However, problems related to the participation of students and the management of edublogs by teachers are also identified. Molina et al. (2016) underline the importance of offering prior and sufficient information about its use in the subject. It can find several researches analysing students' perceptions and motivational aspects of building online learning communities. Ifinedo (2017) shows how perceived self-efficacy, personal outcome expectations, and perceived support for enhancing social ties are pertinent to explain students' acceptance of blog use for learning. Lee and Bonk (2016) study learners' perceived emotional closeness with other learners after using blogs for writing and sharing weekly reflective journals. Students' interactions may be analysed here in terms of the online interactions among them, the numbers of replies that individual learners had posted to and received from others' postings. The findings of Lee and Bonk indicate that, after the use of the blog as a learning tool, peer relationships are noticeably changed at the end of the semester, when compared to that at the beginning. Chawinga (2017), from an educational technology perspective, explores teaching and learning using Twitter and blogs, and shows how they are catalysts for a learner-centred approach to teaching. Piña et al. (2016) highlight that although the blog helps the development of digital skills, it does not guarantee its future use. In this sense they emphasize the importance of combining the blog with reflective writing strategies, with a feedback of formative character and with the use of other social networks. Shana & Abulbdehb (2015) also argue how blogs may be used as a tool to facilitate deeper learning, through the use of open-ended questionnaires, student journals and reports, and end-of-class e-portfolios. Blogs have the potential to empower and enhance student learning.

1.1 Cooperative group-based learning

One of the main characteristics of cooperative learning is the positive interdependence among different learners with a common objective because the interaction and the contribution of each member of the group is needed. The dynamics to promote cooperative learning are oriented to the responsibility of each person and also the mutual compromise to perseverate in front of difficulties. The decentralized autonomy, by the distribution of roles and tasks, entails major gains in consensus and conflict resolution skills. Students also develop interpersonal relations and social skills as active listening, dialogue and encourage and respect others. Lastly, using 2.0 tools in class has a key value related to digital alphabetization. The use of the digital social network could promote a continuous training process of personal, civic and community process. In this sense, it could be assessed by the perspective of the development of critical digital citizenship.

The latest studies with students enrolled in Early Childhood Education Teacher degree and Elementary School Teacher degree in Andalusia and Bask Country (Spain) (Cabrero & Marin, 2014), shown that 80% of students recognize cooperative learning as the best way to learn. But they are less competent to use digital tools as we assume. However, it is also concluded that students are highly motivated to learn about digital tools to using it their future educative practice.

Our innovative teaching group in University of Barcelona (GIDASRES) was created in 2012 and recognized and considered a consolidated innovative group by the Innovative Teaching Program from the UB (RIMDA). The GIDASRES group has developed three projects in different subjects: elaboration and publication of innovative teaching material; using of case study as an innovative teaching tool; and a cooperative students study about an educative real practice. Our overall balance is positive, but we considered that we have to reinforce some points that we try to work with the present innovative project. The experience that we present is about the introduction of an innovative project to reinforce the cooperative learning creating a blog. This project is recognized by RIMDA office of University of Barcelona (2018PID-UB/007). The duration of the project is two consecutive academic years implemented in coordination among different teachers of the same subject in different studies of Education Faculty (Early Childhood Education Teacher degree and Elementary School Teacher degree). At the end of the first academic year (2018-19) we have done an assessment by students and a personal assessment. We have identified points to reinforce and improve for the next year.

2. Objectives

The main object of the innovative project is to ask students to create a web blog to promote de cooperative learning and to developing an ethical and social perspective. We try to

consolidate working methods and required tools in order that students engage with their learning process and develop transversal skills requested by university. This skills are in the different subject programs: a) ethic commitment; b) learning and responsibility skills; c) communicative skills; e) creative and entrepreneurial skills f) team work. The specific objectives are, that the students:

- learn to be respectful and critical of the internet publications.

- create texts in cooperative way and share them on the internet.

- improve their oral and writing communication.

- learn to assess, and value rigorously the tasks of other students.

- develop their proactivity, important for their future teaching task.

- develop team group skills.

- search information on the internet, and be able to filter it critically.

- develop learning skills in digital context in order to construct a critical citizenship.

3. Innovative project development

This project is designed to be implemented in two academic years (2018-2019 and 2019-2020). After the first year we assess and make a reflection about the initial implementation and the student's acceptation. This innovative experience, carried out by 6 teachers, is implemented in a subject of two university degrees (Childhood teacher training and Primary teacher training). The compulsory subject is in the first semester of first year with 6 credits: Sociology of Education: educative, multicultural and social changes. Approximately there are 50 students by group and in each class were more or less 10 groups of 5 students who created a blog with some information in common and some different information.

In order to reach the objectives mentioned above each group of students has to distribute the tasks to do the posts on the blog –they have to summary texts, present investigations, critical analysis of laws, presentation of study cases, presentation of educative real experiences, critical analysis of films, etc...- Some of these activates required an oral presentation in class in order to facilitate peer learning, oral communication skills and co evaluation, among others. Our point is to improve the utility and to approach the professional reality to the students. It is also a source of information for teacher to assess their efficacy in the tasks. It is clear that the continuous assessment is clue in this project and the feedback is required for the good development of student learning. Each teacher

decided the specific task that all the groups and just one of them has to develop, we think the flexibility is clue for the good development of the project.

4. Experience assessment

Because of each group has to create a post and share it, the learning is an active and dynamic process taking into account the different learning styles of students and the different digital skills. The material of all the tasks are public on the blogs and all the class can participate in other blogs throw the comments. Evaluation and co evaluation is used to assess the tasks, particularly the cooperative work.

5. Results

Two evaluation processes were proposed during the course in order to know the impact of this innovative experience on student learning. Firstly, a co-evaluation where each group was asked to evaluate three different blogs from the same course at two points in the course (mid-year and end of course). The students were asked to evaluate the quality of the text, the constancy of the entries, the formality, the link between theory and practice and the dynamism as a social network. This evaluation had a formative purpose and it was in group. Secondly, a self-evaluation that each student does at the end of the course, based on ten items about the learning done through the blog. This consisted of a questionnaire survey where students, individually, were asked about the usefulness of the blog for the acquisition of the different skills shown in the table 1. The assess questionnaire has 10 items to evaluate from 1 to 10, and at the end there are two open questions. The two questionnaires were published on the Moodle platform in order to facilitate their completion as much as possible.The results of the self-evaluation are shown in following table.

Table 1. Average valuations in the acquisition of training skills. Academic year 2018-19.[1]

	Mean
Linking between theory and practice	**6,8**
Approaching to the content in a responsibility way	**7,1**
Creative and entrepreneurial skills	**7,2**
Writing skills	**6,8**
Reflexion and critical thinking	**7,2**
Proactivity and participating to reach the results	**7,6**
Being respectful and honest with the authorship	**7,3**
Oral exposition of ideas to obtain consensus	**7,6**
Being aware that the publications in internet have transcendence	**7,0**
Being respectful of another points of view	**7,0**
Total mean	**7,2**

We consider that the answers were globally positive. The improvement of oral skills and the proactivity and participating to reach the expected results have the highest punctuation. The relation between theory and practice is the less punctuated, this topic is always difficult to develop in an academic university class. From two open questions we obtained qualitative valuations about the blog innovative experience. The questions were 'Pros and cons about the innovative experience to create a blog? Which are the relevant contributions of creating a blog in collaboration with another students?

Regarding the **cons,** most of the student's answers were coincident. Some considerations are about the organization and dedication, some students mention difficulties to meet all together to do the work, or some of them mention the different effort devoted by the different members of the group. Most of them think is a cons when they cannot choose the colleagues of the group. They pointed out the lack of time to transform the academic task in a post to show on a blog. Students also see some problems because they recognise that don't have enough technical knowledge to develop a proper blog, most of them have never created a blog before. Some of the comments of the students have to be in consideration for the next year, they requested more time in class to develop the blog with the teacher

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[1] 262 participants.

guidance and help. And they also pointed out to need some help to develop skills to reach consensus to decide the final drafting of the posts.

The **pros** could be summarised as this student say: "Being able to write and share about interesting topics for you and for other colleagues". Students are motivated to share their knowledge with colleagues, teachers and other people interested. Most of them say that it project improves their cooperative skills being more efficiently working in group. Finally, they pointed out that the innovative project allows them to see the society in a critical point of view.

This cooperative project is the first they develop at university. In this sense, they recognise that the experience has important impact in the way to think, share the knowledge and convince others. They say it was useful to summary the information and to try to explain thinks thinking on the audience. They define the innovative experience as an activity which allows cooperation and creativity and commit them to the subject during all the semester. Some of them state that the creation of the posts helps them to interiorize the concepts and understand better the material explained in class.

It is important to mention that our objectives are quite optimistic. We think that the project of creating a blog could improve the commitment in their learning and their ethical and social perspective in the tasks. We think we obtain the first part of our objective but not the second. Improve the ethical and social learning required more time and more guidance by teachers. However, most of students consider this project very interesting because they have to share different points of view, task that have never done it before. They recognise that the fact to do a writing that has to publish in internet has a different transcendence Thant a writing just for the class or the teacher. This situation develop auto critical skills. Students also pointed out that they have improve the skills to search relevant information on internet. The project improve their capacity to summarise and structure the information. This project allows to share values, opinions and respect others, and also they had to improve the organisation and planning to reach de commitment with other colleagues of the group and the colleagues of the all class. Being aware to be active on the blogs pushed them to be committed with the tasks, and also allows them to be creative, drawing, searching links, making gadgets, doing good photos or searching it. They say that have discovered which thinks could contribute each member of the group, being aware of their strong and weak points.

With regard to the co-evaluation questionnaire of the blogs of the other groups, it should be noted that the students generally value the work expressed in it very positively. However, students are more critical about the use of different tools offered by a blog, sometimes scarce and little worked. This leads some groups to appreciate that the relationship between theory and practice is sometimes infrequent and has helped little to understand the contents.

So the feedback between colleagues has helped the teaching team to demonstrate the need for more collaborative work between teachers so that all groups produce what some have already achieved, which is learning to learn by making a stronger link between theory and practice.

6. Final considerations

Cooperative learning in framed in a sociocultural context where the 'how' (socially) and the 'where' (internet) of learning have transcendental values. We are aware that we have to go further in this way. Vygotsky (1979) recognised that learning is a social phenomenon and we learn because of the interaction with others. Following Gros (2000) in cooperative learning different members of the group commit to learn all together. The result only appears when the group work with the same objective that have to decide who works, when and in which way. It is important for us to guarantee in the future that all the members of the group have the same commitment and do the same effort avoiding free riders. Although it is difficult, as Zañartu (2011) conclude, to differentiate the time devoted in the work when it is in group. Since now we see that students have divided the tasks and put all together at the end, but now we want to do a further step trying to guarantee the commitment of all the members.

Cooperative learning by internet could be a teaching learning strategy as Johnson (1993) recognized. Students construct their knowledge throw discussions, reflections and decisions. A computer is a tool to develop this task and to share with other colleagues in class. We have to invigorate the knowledge construction of students, especially with the students with more difficulties. The same author recognise that this learning stimulates the individual initiative. Students when take part of the group put their abilities to reach a decision, it stimulates their motivation enriching the productivity. A part from to improve their self-steam and improve their social and ethical values as the solidarity and mutual respectfulness. It is also important for us, to obtain ways to be sure that this learning is useful for their future professional life.

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T-shaped engineers: getting ready for employability

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Abstract

Even though knowledge transfer remains the starting point of any career, it is without a doubt that professional success goes beyond the acquisition of sound expert knowledge. In fact, the inevitable challenges of increasing flexibility on the labour market can only be mastered by embracing an interdisciplinary approach when educating future employees to meet the social and environmental standards and demands. In order to pursue a successful engineering career T-shaped engineers need to enter the labour market in order to pave the way to innovation. Based on an online survey among potential industry partners and a follow-up SWOT anaylsis at the faculty of Applied Computer Sciences, a training course was developed at the department of computing compromising communicative, social, entrepreneurial and innovational aspects – skills that usually go beyond the major classes of the curriculum. The research aims to show how a professionalization of students, being originally enrolled for a traditional computing degree programme, can make a difference in attaining a successful career and and thus further impact their overall future of employability.

Keywords: Employability; Key skills; T-shaped engineers.

1. Introduction

Computing professionals are in demand worldwide. Apart from Austia, other European countries and even the US seek IT professionals since digitalization is *the* key player in almost every business. According to Bahler (2018) these professionals play "an increasingly popular and important role in the tech space" and thus IT graduates do have great opportunities landing well-paid and fulfilling jobs. Despite this quite promising outlook, a recently-conducted small-scale study at our deparment has shown a quite different picture. Although our IT gaduates do show an excellent adacemic profile, they often lack certain skills and competences which should help them to thrive in a globalized world.

These skills can be labelled as so called transversal skills as they usually unfold entrepreneurial skills, leadership qualities, problem-solving skills, an awareness for business ethics and (foreign) communication skills as well as critical thinking competences and interpersonal skills. Although the Bachelor curriculum at the IT department does have a quite comprehensive design - some courses do already cover these transversal skills - it seems that graduates miss to see what kind of additional qualifications they bring along to their job interviews and respectively later to their jobs. This notion has been further investigated in a recently conducted small-scale study among long-term industry partners and future employers. In form of five open-ended questions, we asked them to participate in a small survey to see if the investigation confirms our hypothesis of observing a lack of tranversal skills among our respective graduates.

Based on the results of the survey and a SWOT analysis at the faculty, an action plan was developed in order to increase the visibility of transversal skills. For this purpose a so-called training week, piloted during summer term 2018, was introduced which had the aim to prepare students better and more effiencitly for employability.

The paper at hand covers the main aspects of a T-shaped engineer before it briefly elaborates on the small-scale study conducted. In the final section, the professional training week is explained in detail. The paper finishes by discussing if such intiatives might be an appropriate way to raise awareness of students' potential outside their academic comfort zone.

2. The T-shaped Engineer

The concept of a T-shaped engineer, as shown in Figure 1, includes content expertise on the one hand and multi-disciplinary skills on the other hand. To visualize these abilities the "T" serves as a metaphor for describing the depth and breadth of a person's competences and skills. In doing so, the vertical leg on the T should reflect the depth of relevant skills and

competencies in a single area whereas the horizontal one describes the ability to think-outside the box by acquiring and applying knowledge in fields of expertise other than one's own (see Tranquillo, 2017).
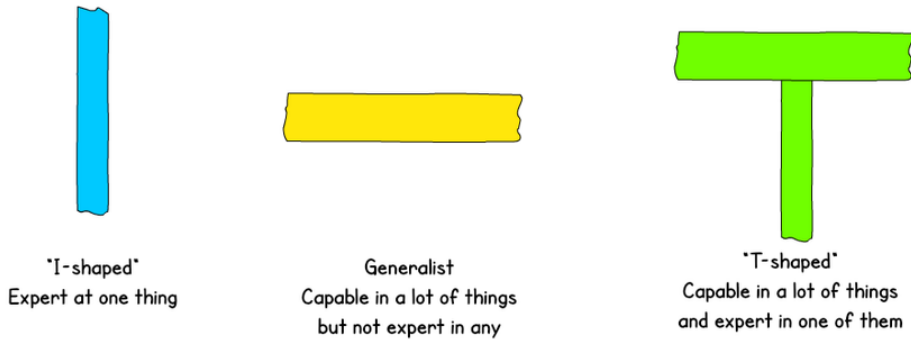

"I-shaped"
Expert at one thing

Generalist
Capable in a lot of things
but not expert in any

"T-shaped"
Capable in a lot of things
and expert in one of them

Figure 1. T-shaped Engineer Matrix (image by Jason Jip)

According to Grasso & Brown Burkins (2010, p. 1) "the exciting future of engineering is beyond technological labels (e.g., mechanical engineer, electrical engineer, and chemical engineer), which represents for a "more cross-disciplinary, whole-systems approach to engineering that "emphasizes contextualized problem formulation, the ability to lead team-centered projects, the skill to communicate across disciplines, and the desire for life-long learning of the engineering craft in a rapidly changing world. " In other words, tertiary education has to consider how "to cultivate professionals take on the most complex technological, social, environmental, and economic challenges facing today's societies" (ibid, p. 2).

3. Methodology

A mixed methods strategy was employed, in the form of an online survey and face-to-face discussions (SWOT analysis) within the faculty to better capture the complexity of the topic in question. For our online survey we designed five open-ended questions where we asked particiants to report on their point of view when it comes to describe the additional skills and competences of our IT graduates, what job-related issues have changed in recent years, which challenges future employees have to face and what suggestions they have to make students better prepared for the future. With this rather broad scope of questions industry partners had the chance to highlight all aspects of change that they associate with employability and transversal skills. The survey was distributed via surveymonkey and reached out to over 30 industry partners of which only 10 responded.

The survey was conducted in German and the following questions were outlined:

1. In your opinion, how prepared are our students for employability in the 21st century? Apart from their expert knowledge, what kind of skills and competences are they already equipped with?
2. What has changed in terms of employability in recent years due to globalisation?
3. What kind of challenges in the world of work do future emyployees have to face?
4. When we speak of so-called transversal skills, what should these skills unfold?
5. What qualifications and training might be worth considering at tertiary level in order to increase the T-shaped mindset among our stundents?

The data from the survey were collected and a thematic analysis (see Braun and Clarke, 2006) was made based on the main principles of a T-shaped engineer. This form of analysis helped to shape the content of the survey in order to discuss the answers in more detail.

These results finaly led to a so-called SWOT analysis (see Gao and Peng, 2011). Gürel & Tat (2017, p. 995) describe the SWOT Analysis as "a tool used for strategic planning and strategic management in organizations. It can be used effectively to build organizational strategy and competitive strategy. In accordance with the System Approach, organizations are wholes that are in interaction with their environments and consist of various sub-systems. In this sense, an organization exists in two environments, one being in itself and the other being outside. It is a necessity to analyse these environments for strategic management practices. This process of examining the organization and its environment is termed SWOT Analysis". In other words, a SWOT anaylsis is an essential planning framework to evaluate not only an organization or a project but also other activities that might contribute to the success of a company. It helps managers to analyse a situation in depth. According to Gürel & Tat (2017, p. 995) a "SWOT Analysis has two dimensions: internal dimension includes organizational factors, also strengths and weaknesses, external dimension includes environmental factors, also opportunities and threats".

Based on the SWOT analysis, an action plan for the faculty was set up in order to raise awareness of transversal skills among faculty members and students alike.

4. Findings

4.1. Summary of the Survey

From the survey the following conclusions could be drawn:

In general, our industry partner do have a very good impression of our students. The know-how of our graduates as well as their content expertise got mentioned several times. In addition, they were also quite satisfied with the foreign language skills of our students. Since some of the companies do have English as the working language, our industry

partners highlighted that it is surprisingly natural for our graduates to switch to English in meetings and telephone conferences and during company visits.

Secondly, the online survey stressed that the future of employability needs to be addressed more closely at higher education as digitalization will cause some changes in employees's skill set. Content expertise will no longer guarantee well-paid and successful jobs, future employees will have to bring along more competencies and skills which may usually go beyond their compfort zone. An IT engineer, for example, will not only have to take care of the company's IT infrastructure, he or she will also have to negotiate software contracts, lead a team of experts, and will eventually have to rely on his entrepreneurial skills when starting an own business. Due to globalization working abroad and regular business travels might also be part of the job description as well as social skills and sound communicative competence.

When describing the skills of a T-shaped engineer the answers were manifold. Some mentioned leadership skills, an entrepreneurial mindset, communications skills in German and in English, advanced writing styles, negotiation skills, background in economics, spirit of innovation, commitment, independent work and creativity. In terms of training and further education, respondents stressed the importance of life-long learning and the benefit of a growing mindset that "you never stop learning".

4.2. SWOT Analysis

The results of the online survey were discussed in several faculty meetings.The final meeting was based on a so-called SWOT analysis. Figure 1 is a visual representation of the main results. In the SW
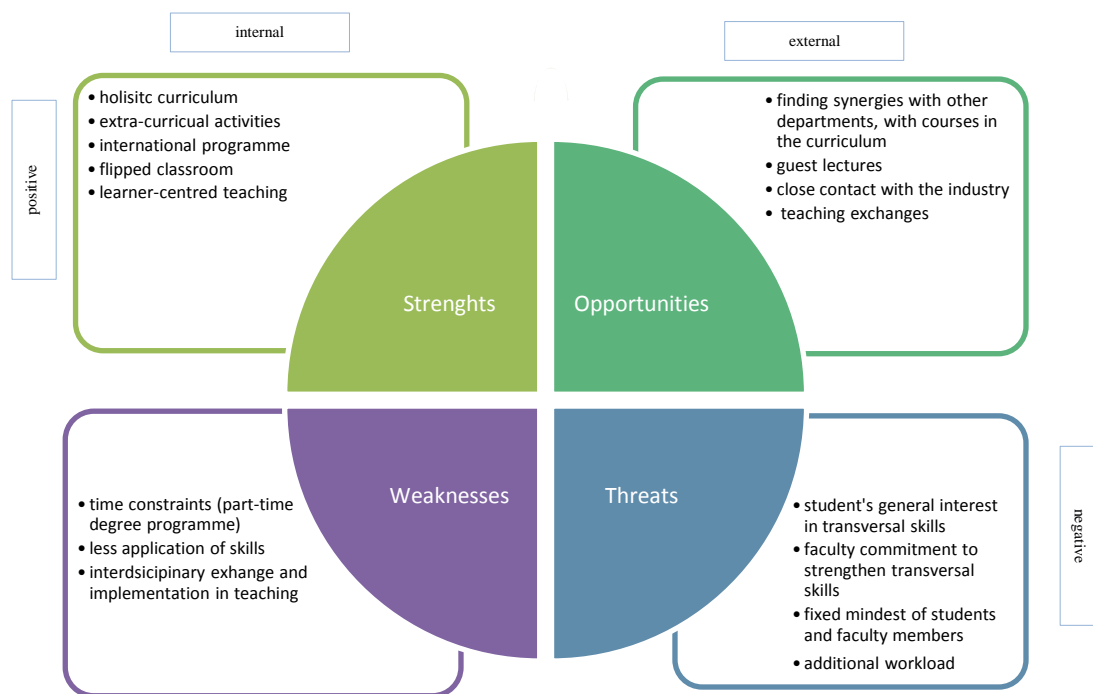
Figure 2. SWOT Analysis Transversal skills

Following on from the SWOT analysis, an action plan was set up to address the differen areas of the SWOT anaylsis. Since several topics would need intensive planning and could not be implemented ad hoc, the faculty agreed to implement a professional training week for students in order to strengthen their T-shaped mindset. The aim of the training week was to remind students of their acquired skills and competencies. In doing so, several key issues based in the SWOT analysis were addressed before students started to apply for an internship or a position in a company. In other words, this boost in self-confidence should make our future graduates more aware of who they are, what they know and what asset they bring to the respective company.

4.3. Professional Training Week @ IIT

The professional training week has a T-shaped designed. Workshops, counselling sessions, feedback meetings and events were set up in the light of transversal skills. The working language of the whole week was English. The following overview should give an insight into the different activities:

Table 1. Professional week at a glance.

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Morning Session	Teambuilding	Entrepreneurial Management	Insights into Assessment Centers	Client Interaction Skills	"Sales Pitch" Appathlon
Afternoon Session	Written Communication	Leadership Development	Polishing your CV and perfecting job interviews	Decision Making & Critical Thinking	Social Event

5. Discussion and further implications

Without a doubt, the job market has undergone a huge transformation in the last couple of years. Due to digitalization and the introduction of the so-called 4th industrial revolution the employment landscape is rapidly changing. The field of engineering is deeply affected by this development as they build the centre of this transformation. In fact, future careers are just beginning to emerge and ordinary skills and education will no longer suffice in order to meet the challenges of the future. As more and more tasks are automated human skills become more valuable. In line with Gray (2016), these skills are

1. Complex Problem Solving
2. Critical Thinking
3. Creativity
4. People Management

In terms of life-long learning and education, stakeholders and educational institution will thus have to reconsider their strategic orientation to make graduates ready for the future.

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Projects to encourage female students in STEM areas

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Abstract

Today, the number of female students that enrol in degrees related to Science, Technology, Engineering and Mathematics (STEM) areas is quite low. So, numerous initiatives have arisen to promote these degrees and encourage female students in these areas. In this context, the EuLES Network (u-Learning Environments in Higher Education), an interdisciplinary network created in 2010 at the University of Zaragoza (Spain) to foster research, interaction, cooperation and transfer of knowledge and technologies related to learning and open education, has developed two projects oriented to High School Students: "WikinformáticA! en Aragon" and "Women in STEM by EuLES". WikinformáticA! en Aragón is a competition for student groups in which they develop a wiki on prominent women in the history of Information and Communication Technology (ICT). The objective is the visibility of women involved in technology. The purpose of the Women in STEM project is to offer testimonies of women in Science, Technology, Engineering and Mathematics to encourage scientific vocations, especially in young people and girls. The project consists of conducting video interviews of women who work or study in these disciplines. All the videos, along with a short biography, are posted on the web.

Keywords: ICT; collaborative work; gender equality; wikis; EuLES network; STEM.

1. Introduction and motivation

The EuLES Network (Allueva-Pinilla, Alejandre-Marco, Trillo-Lado, & Lozano-Albalate, 2017; EuLES, 2011) is an interdisciplinary educational research network in uLearning environments in higher education. It has been recognized as an Interdisciplinary Network of the University of Zaragoza, within its incentive programme of educational innovation, since 2010.

The objectives of the EuLES Network are the promotion of the interaction and cooperation, transfer of knowledge and technology, and the exchange of experiences and resources among its members and the rest of the educational community, in relation to uLearning environments at a higher education level. We consider the network as a wide model where the different evolutions of the learning process combined with the latest technology trends are combined. Thus, some trends considered are: bLearning models (Blended Learning), eLearning, mLearning (Mobile Learning), Web 2.0 and the concept of ubiquity, that allows us to develop the teaching-learning process at any time, place and situation.

The purpose of the EuLES Network is to contribute to the development of training activities, exchanges, mobility and scientific interaction, while increasing the visibility of the participant institutions, and thus also to contribute to collaboratively create and share knowledge to improve the teaching quality.

For several years, a fundamental concern of this Network has been the role and presence of women in the education environment, and particularly in STEM (Science, Technology, Engineering and Maths) areas. This vision is consistent with one of the objectives presented in Article 23 of the Organic Act 3/2007 for effective equality between women and men: "The education system will include among its aims the teaching of respect for fundamental rights and freedoms and equal rights and opportunities for women and men. Likewise, the principles defining education system quality will include the elimination of obstacles that thwart the effective equality between women and men and the furtherance of full equality between the two sexes."

The acronym STEM specifically refers to Science, Technology, Engineering and Mathematics, but there is no standard definition for what constitutes a STEM job. In these fields, there is also an agreement to include other positions, such as educators, managers, technicians, healthcare professionals, and social scientists (Beede et al., 2011). On the other hand, there are variations in the identification of academic disciplines included in this acronym. The National Science Foundation (NSF) uses the term Science and Engineering to include agricultural, biological, and computer Sciences; atmospheric, earth, and ocean Sciences; Mathematics and Statistics; Astronomy; Chemistry; Physics; aerospace, chemical, civil, electrical, industrial, materials, and mechanical Engineering; social Sciences, and Psychology (Johnson, 2011; Rodríguez, 2016).

The focus of the EuLES Network is placed on the most global meaning of the STEM term. Accordingly, we try to encourage the visibility of women in all the related areas. For example, the "Women in STEM by EuLES" project consists of conducting video interviews of women who work or study in STEM-related disciplines. Similarly, the "WikinformáticA! en Aragon" project implies the development of a contest among teams of high school students that are in charge of developing wikis to help visibilize women with prominent roles in STEM areas. The main motivation for these projects is that there is still a very significant gender gap in STEM studies, at Spanish Universities in general, and particularly at our university, the University of Zaragoza.

Table 1 shows the evolution of new enrollees in scientific-technical studies and Physics degree in the Spanish university system and also the percent of women, from information drawn from official sources. Overall, the percentage of women enrolled in Science, Mathematics or Engineering careers is around 30% in Spanish universities (National Science Foundation & National Center for Science and Engineering Statistics, 2017). This global data, is already significantly unequal, but there are also cases and degrees where the percentage of women enrolled is even lower. In a recent study (Allueva-Pinilla et al., 2018), authors of this paper analyzed the current situation of the University of Zaragoza in relation to the STEM areas. So, it is really worrying.

Table 1. Evolution of new enrollees in scientific-technical studies and Physics degree and percent of women.

Academic year	All degrees and universities	Scientific-technical studies	Women in scientific-technical studies (in percent)	Physics degree	Women in Physics degree (in percent)
2013-2014	382060	94609	28.9 %	2916	25.7 %
2014-2015	356447	90166	29.5 %	3023	25.0 %
2015-2016	345835	82505	30.0 %	2871	26.6 %
2016-2017	340988	80104	30.2 %	2901	24.9 %
2017-2018	340274	79614	30.6 %	2943	28.5 %

Source: Own elaboration based on information from INE (Spanish National Institute of Statistics) and Ministerio de Educación, Cultura y Deporte (Ministry of Education, Culture and Sport, Spain).

According to data from the Equality Observatory (Observatory of Gender Equality & Vice-rectorate of Culture and Social Projection of the University of Zaragoza, 2017), in Sciences there are 50% of female students, but only 28% in the Physics Degree. The data is much worse in Engineering and Architecture, where, in the whole of the macro area, only a scant 21% is reached. But if we carry out an analysis by degrees, the data get much worse: in Electronics and Automation Engineering it falls to 18%, in Mechanical Engineering to 15%, in Electrical Engineering to 14%, in Mechatronic Engineering and Informatics Engineering it does not even reach 10% (9.9% and 9.8%, respectively), and finally, in Industrial Organisational Engineering, it falls to a very low 6%. These values are really low, but the current trends are not promising either: if we analyze the evolution in Engineering studies during the the last ten years, we see a decline with a loss of more than 5% in the percentage of female students.

Figure 1 shows the distribution of graduate students at the University of Zaragoza by branch of knowledge and sex (Observatory of Gender Equality & Vice-rectorate of Culture and Social Projection of the University of Zaragoza, 2017). There is a reduction in the percentages of women graduates in all macro areas. It is highlighted that the gender gap is increasing in Engineering and Architecture.
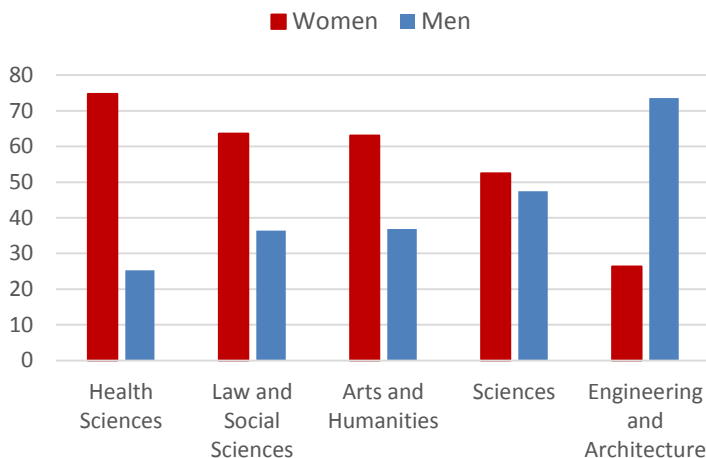
Figure 1. Distribution (in percent) of graduated students at the University of Zaragoza by branch of knowledge and sex. Academic year 2015/2016. Source: Observatory of Gender Equality (2017).

On the other hand, there are disciplines in which the number of female students is higher than that of men, as in the case of health studies, where it exceeds 70%, or as it happens with some degrees such as Nursing, where 80% of the students are women. But, what happens next? In these areas, as in the others, positions of responsibility in scientific research or in the business field are not held by women. As an example, the data by sex on

the number of Full Professors and Associate Professors (or lower academic ranks), obtained by querying the transparency portal of the University of Zaragoza (University of Zaragoza, 2018), offer proof of this.

2. WikinformaticA! en Aragón Project

WikinformaticA! en Aragón 2018 (EuLES, 2015; Lozano Albalate, Trillo-Lado, Villarroya-Gaudó, Allueva, & Cerezo, 2015) is a contest where teams of students from high school and last courses of primary education make Wikis about technologists or scientists related to Information and Communication Technologies (ICT). In this contest (organized by several members of different groups from the University of Zaragoza: Departamento de Informática e Ingeniería de Sistemas –DIIS- of the Universidad de Zaragoza, Asociación de Mujeres Investigadoras y Tecnólogas –AMIT- and Red EuLES -Entornos uLearning en Educación Superior-), the potential of the Wikis is used to promote collaborative work, the use of tools for the creation of Wikis, and the publication of reliable Web content. Besides, this contest also aims to visualize the role of women in the development of Information Technologies and the Communication by making visible relevant women in the ICT world, in general, and women related to ICT who have had some kind of relationship with the University of Zaragoza, in particular. In this way, we want to contribute to provide an early positive experience in the use of technology and decrease the imbalance in the presence of women and men in Internet content, in general, and in Wikipedia in particular.

The teams of students that participate in the contest have to find out the name of certain relevant women in the field of Information and Communication Technologies (ICT) from different clues. After that, they must create articles in Wiki format dedicated to these women. Therefore, the objectives for a team of students, can be divided into technological (facilitating the use of tools and making visible different contributions to technology) and promoting gender equality (making visible the role of relevant women in the ICT world and encouraging reflection on the presence of women in technology), in both cases from education and development.

In more detail, the objectives we proposed when defining this contest were the following:

- Promote the use of Wikis and collaborative work among participating students.
- Give the opportunity to students to participate in a project, learning different technologies related to the search of information and publication of content in networks.
- Visualize the role of women in the development of Information and Communication Technologies (ICT), especially that of young researchers and entrepreneurs who collaborate actively with the University of Zaragoza.

- Encourage participants, especially students, to become Wikipedia editors (given that currently, less than 15% of Wikipedia's editors - the largest encyclopedia most consulted today - are women), showing them to make edits and publications in a collaborative way using Wiki tools is a simple task and can lead to quality work.

To achieve the objectives in the contest, students must create teams composed of a number of persons between 3 and 8. Because most of the participating teams are formed by adolescents, and taking into account the current problems of legislation related to personal data and privacy, it was decided that the teams were led by a teacher (or supervisor). In this way, the organization of the contest only required the data of the teacher in order to allow a team of students to register in and participate in the contest. In addition, the teacher acts as a supervisor of the student team and as a intermediary in communication with the organization.

The edition of the contest "WikinformáticA! in Aragón" in 2018 was launched in September and ended on December 20. More than 700 students from different schools organized in 135 teams signed up. Besides, all of them finished their work on time. Finally, four prizes were given to the best works.

3. Women in STEM by EuLES Project

Women in STEM by EuLES is a recent project and is still under development. This project started in 2018 in order to collaborate in the celebration of the International Day of Women and Girls in Science, that is celebrated on February 11.

The purpose of this project is to offer testimonies of women in STEM areas, as well as other resources developed by the EuLES Network to encourage scientific vocations, especially in young people and girls.

A detailed description of this project can be found in Allueva *el al* (Allueva-Pinilla et al., 2018). Briefly, our research methodology in this research project consists of searching and contacting scientific women or female professionals and students in order to conduct video interviews, editing and publishing the recorded videos, and writing the biographies of the women interviewed. All the videos have been made by the authors and the tool used for recording and editing has been ScreenCast-O-Matic. In this way, one of the main tasks of the project consists of conducting video interviews of women who work or study in these disciplines. The videos are freely available in the YouTube channel of the EuLES Network and also in a specific portal, Women in STEM, in blog format (EuLES, 2017) organized and classified by themes.

Our intention with this project has been to provide a vehicle by which the voices of scientific and professional women could be heard more, reaching girls and young students who have to face an election about their future studies.

The interviews in this project have focused on prominent women in STEM areas but also on women who are starting their careers, considering academic / research, professional, and even political fields, as well as Master or PhD students. In the interviews, all the women speak of their life experience, of the peers they have had, and of the difficulties they have encountered in their professional career, but also of the kindnesses and satisfactions that their work has given them.

4. Conclusions

In this paper, we have presented two projects developed with the goal of encouraging the participation of women in STEM areas. To do this, both projects make explicit the key role played by women in science and technology.

The possibility to see and hear testimonies from women working in STEM areas allows vocations to be generated in young students, which has motivated our work with the "Women in STEM by EuLES" project. The experiences reported by the women interviewed show the difficulties they have encountered in their field of work, but they also emphasize the changes that are taking place in recent years in favor of gender equality, as well as their full satisfaction for having chosen to study in any of the STEM areas.

The high number of people that have participated in the WikinformáticA! en Aragon contest has helped to promote the role of women in new technologies, thus achieving the main objective of this project. This contest has had great diffusion in the media, press, radio and television. Moreover, it has aroused great interest among secondary education centers. Many of these centers request information about the contest even before its annual call.

The projects presented in this paper not only promote the role of women in STEM areas. Besides, they bring middle school students closer to the university and promote the incorporation of students, especially women, into the first courses of teaching in scientific and technical areas. For this reason, we will continue to work in the organization of the next edition of the WikinformáticA! en Aragon contest as well as recording, editing and visualizing testimonies of women in STEM areas.

Acknowledgements

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Assessing L2 listening in CALL and listening strategy use

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Abstract

This longitudinal study examines students' learning strategies of 222 Spanish intermediate learners when taking several listening tests. It also examines the effect of different instructional formats (online-hybrid vs. face2face-blended) on the learners' strategy use. There were four versions of the same aural text: an audio format, a video format, a redundancy-enhanced version in audio format, and a redundancy-enhanced version in video format. A pseudo-crossover design was utilized for this study with four listening tests used with each online-hybrid, face2face-blended and control groups. Participants completed a questionnaire immediately after each listening test to learn about learners' strategies before, during and after listening in order to elicit information about the particular strategies that learners used to complete each listening test.

Results indicated that there was a listening comprehension strategy development over time without explicit instruction, but participants from different instructional formats developed different strategies. There was a statistically significant difference for intermediate-low learners when perceiving the use of cognitive and metacognitive strategies, but the effect of redundancy does not seem to help students to use different types of strategies. Intermediate-mid learners did not perceive a difference with the use of strategies when completing listening tests with or without redundancy.

Keywords:listening strategies; online-hybrid; face2face-blended;redundancy.

1. Introduction

When teaching a foreign language such as Spanish within the first three years of undergraduate studies, there is not always time in the classroom to teach listening strategies, especially if the textbook in use does not include a section to improve listening comprehension (LC). However, there are many studies about the importance of teaching listening strategies to help achieve comprehension (Nogueroles López & Blanco Canales, 2017; Roussel, 2011;Vandergrift, 2008), but the reality is that even when a textbook includes a section with listening strategies, not much time is devoted to help learners develop cognitive and metacognitive strategies. Instead, students read on their own the listening strategy section and practice their listening with online resources from the adopted textbook or external applications.

After fifteen years of teaching, observing, and evaluating foreign language classes in my role as a graduate student, researcher, assistant, and associate professor in three American research universities, I noticed that listening strategies are not taught unless a research project is conducted or the adopted textbook includes a section on how to develop listening strategies. Instead, foreign language instructors use the target language with extensive comprehensive input for their students to fend for themselves in communication situations. Instructors also do their best to include communicative activities in their lesson plans with the idea that their students will speak the target language. Furthermore, today more instructors include applications of online computer assisted language learning (CALL) in their programs as part of homework to facilitate language learning. When doing listening activities in the classroom, some instructors ask their students to read the context, instructions, and questions before listening to the audio repeated times. Then, the instructor will allow students time to answer LC questions.

There are many research studies in L2 listening strategies in the classroom setting, but there is a scarcity of studies with online CALL settings (Chen et al., 2013). Previous research has focused on teaching, proficiency levels and reporting listening strategies in a classroom setting (Nogueroles López & Blanco Canales, 2017; Vandergrift, 2008). Roussel (2011) tracked the movements of the computer mouse while a learner listened to an aural text in order to represent L2 learners' listening strategies, reporting not only what learners say that they did, but what they really did. Chen et al., (2014) used a web-based CALL setting to explore how motivation, learning styles and anxiety affect the learners' strategy use. Both studies were done within a learning environment, but the present study was conducted within a testing environment. Suvorok (2018) investigated test-taking strategies using eye tracking and cued retrospective reporting when L2 English learners responded listening, reading and grammar items within a computer-based English test. There is need to examine L2 listening strategies within testing and online CALL settings.

This study, therefore, addressed the following research questions in order to specify the listening strategies that learners of Spanish report before, during, and after listening to different aural messages within different instructional formats and different versions of the same aural text within testing and online CALL settings: (1) Are students in the online-hybrid courses using more cognitive strategies than students from face2face-blended classrooms? (2) Does student listening comprehension strategy use develop over time without explicit instruction? (3) Does providing redundant information in listening texts facilitate student use of certain strategies?

2. Listening strategies in CALL

LC is one of the skills needed for language acquisition, but it is also the least understood (Vandergrift & Baker, 2015).Vandergrift's (2008) chapter presents an overview of the strategies used by second/foreign language (L2) listeners to improve their understanding of aural texts, emphasizing the metacognitive and cognitive strategies that direct and control learners' listening efforts. Cognitive strategy relates directly to a learning task and involves the listener's direct manipulation or transformation of learning materials (Goh, 1998). Examples of cognitive strategies, based on Vandergrift (1997) and O'Malley and Chamot (1990), are inferencing (such as linguistic, paralinguistic and kinesic inferencing), elaborating (i.e., using prior knowledge), imaginery (i.e., using mental pictures or visuals), summarizing, translating, repeating a chunk of language, transferring (i.e., using knowledge of one language such as cognates), and taking notes. Metacognitive strategies do not imply a direct processing of input, but rather the executive processing functions of planning, monitoring, and evaluating (Goh, 1998). Metacognitive strategies are important because they oversee, regulate, or direct the language learning process (Vandergrift, 2008). Examples of metacognive strategies, based on O'Malley and Chamot (1990), are planning what needs to be done (i.e, proposing strategies for managing the listening task, directed attention, and selective attention), comprehension monitoring (i.e., checking, self-verifying comprehension at the local level), double-check monitoring (i.e., self-verifying during the second time of listening), and self-evaluating the listening process (i.e., performance self-judging, strategy evaluation, and problem solving).

Findings of studies comparing low- and high-level listeners reported that effective listeners use twice as many metacognitive strategies as less effective listeners, but to regulate listening and achieve comprehension, metacognitive and cognitive strategies need to be used (Vandergrift, 2008). Vandergrift and Baker (2015) also demonstrated that metacognition is the key for L2 listening success. Regarding the use of CALL, there are research studies demonstrating the advantages of learning and assessing with CALL, such as flexibility, self-paced access of information, and visual support (Chen, et al., 2014; Roussel, 2011).

3. The Study

222 Spanish learners at a Midwestern university participated in this research. They were enrolled in intermediate Spanish courses taught with online-hybrid and face2face-blended formats. 117 were intermediate-low Spanish learners (i.e., Span 201) and 105 were intermediate-mid Spanish learners (i.e., Span 202).

When this study was conducted, the textbook in use for intermediate Spanish learners did not include a listening strategy section. It included listening activities and instructors played the audio using a CD-ROM. Sometimes instructors read the script from the textbook instead of using the CD-ROM. Practice with the listening skill was done in the classroom by listening to the instructor and classmates and by doing listening activities from the text. During tests, instructors controlled the audio, playing it twice. For this study, CALL listening tests were developed with video and audio formats related to the type of listening assessment that students used in the classroom (i.e., monologues as a one-way listening). There were four versions of the same aural text: an audio format, a video format, a redundancy-enhanced version in audio format, and a redundancy-enhanced version in video format (Pardo-Ballester, 2016). The differences from a regular listening test were: test delivery (web-based instead of paper and pencil), texts were enhanced with redundancy and the use of videos instead of just audio. These conditions are favorable for the learners because they have control to play the audio whenever they are ready. It is important to notice that because they were listening assessments and not listening activities for learning, participants could not stop, go back or forward the audio, but they could listen to the audio twice before submitting their five answers for each test. See Figure 1 for test 2.
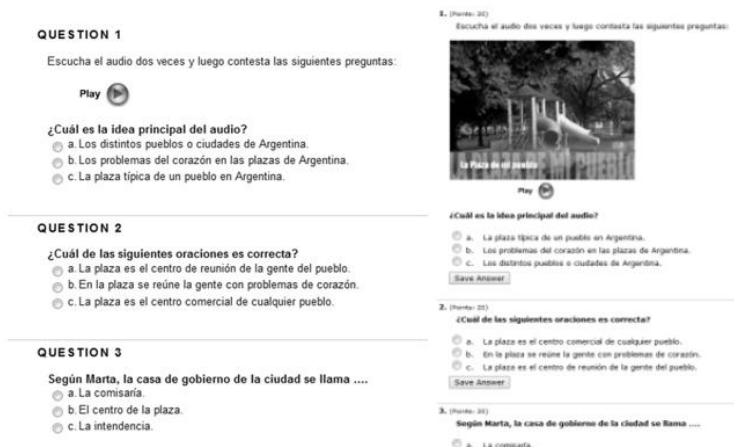

Figure 1. Audio and video versions of the CALL listening test 2

Participants enrolled in face2face-blended courses were present in the classroom three days and one day in the computer lab with the instructor and classmates. The total instructional

time was 200 minutes (50 mns x 4 days). The online-hybrid participants were present in the classroom two days and one day for an online meeting. The total instructional time was 125 minutes (50 mns x 2 =100 mins + 25 mins online meeting =125 mns). Both courses had the same learning goals and were taught with the same communicative pedagogy.

3.1. Data collection

For this study, participants took four extra listening tests during each semester. They completed these tests one day before their actual test. Each test included five multiple-choice items. It served as a review practice, but with the CALL setting. Immediately after each CALL listening test, learners took an online 10 item questionnaire in order to elicit information about: 1) the listening tests with five multiple-choice items about liking, difficulty, easiness, clarity and sound quality, 2) particular strategies that participants used before, during, and after listening with four open-ended questions, and 3) learning new vocabulary with one open-ended question. Data was collected during two consecutive semesters using a pseudo cross-over design. There were three groups (online-hybrid, face2face-blended and control). Learners from the control group were instructed with a face2face-blended format, but they did not take tests enhanced with redundancy.

3.2. Data Analysis

To answer the research questions in this study, the data were analyzed using quantitative and qualitative data analysis approaches. The qualitative data from the open-ended survey questions were coded according to the subsections for the metacognitive and cognitive major categories as they have been defined by Vandergrift (1997) and the O'Malley and Chamot (1990) taxonomy of listening comprehension strategies. Two undergraduate students trained in the identification of the categories independently classified the reported strategy use data. Their classifications were compared with those of the researcher and decisions were made. 1 was used to code metacognitive strategies and 2 was used for cognitive strategies. More codes were used to differentiate between the types of metacognitive and cognitive strategies. 1-13 for metacognitive strategies (global prediction, directed attention, selective attention, double check monitoring, performance evaluation, problem identification…) and 14-28 for cognitive strategies (translation, note-taking, summarization, linguistic inferencing…world elaboration). To compare the results for the instructional and ability groups, we looked at the trends in participants' strategy use and types using frequency counts, means, percents and ANOVA.

4. Findings

R.Q. 1: Are students in the online-hybrid courses using more cognitive strategies than students from face2face-blended classrooms?

Table 1. Frequency counts and percent for groups and proficiency levels

Groups	Cognitive Frequency		Percent Cognitive		Metacognitive Frequency		Percent Meta.	
	IL	IM	IL	IM	IL	IM	IL	IM
Online-hybrid	70	27	17%	11%	343	219	83%	89%
F2F-blended	61	45	8%	15%	569	252	90%	85%
Control	28	46	7%	16%	380	245	93%	84%

Intermediate-low (IL) and Intermediate-Mid (IM)

The qualitative data taken from three questions reported what participants did before, during and after listening to the input was tallied. Intermediate-low learners reported answers to these three questions after completing each of four listening tests. Qualitative data for intermediate-mid learners for the same three questions was collected only for three listening tests due to a technology issue. Table 1 shows the frequency counts and percents for instructional and ability groups (intermediate-low and intermediate-mid learners). Data from Table 1 shows that the intermediate-low learners from the online-hybrid group used more cognitive strategies (17%) than their counterparts (8% and 7%), but intermediate-mid learners from the F2F-blended and control groups used more cognitive strategies (15% and 16%) than the online-hybrid group (11%).

The descriptive statistics associated with strategy use across the instructional and ability groups are reported in Table 2. In order to see if there was a statistical significance in means among instructional groups, a between-groups ANOVA was performed first for the intermediate-low learners. The assumptions of homogeneity of variances was violated based on Levene's F test, $F(2, 1448) = 46.45$, $p = .000$. Therefore, the Brown-Forsythe test was used due to unequal variances as well as unequal sample sizes. This test revealed a statistical significance difference in strategy use $F(2,1141) = 11.544$, $p = .000$ among means (1.16, 109, and 1.06) of the three groups for intermediate-low learners. To study which group was different from another the Games-Howell post hoc test was used because equal variance was not assumed. There was a significant difference between online-hybrid and F2F-blended (mean difference .072, standard error .021, $p = .003$) and between online-hybrid and control groups (mean difference .100, standard error .022, $p = .000$), but there was not a significant difference between F2F-blended and control groups (mean difference .028, standard error .017, $p = .230$) of intermediate-low learners. To study the differences in means (1.10, 1.15 and 1.15) for the intermediate-mid learners, a between-groups ANOVA was performed. The assumptions of homogeneity of variances was violated based on Levene's F test, $F(2, 831) = 6.250$, $p = .002$. Therefore, the Brown-Forsythe test was used

due to unequal variances as well as unequal sample sizes. There was not a statistical significant difference in strategy use F $(2,830)$ =1.495, p =.225 among means (1.10, 1.15, and 1.15) of the three groups.

Table 2. Descriptive statistics for overall strategy use for groups and proficiency levels

Groups	Frequency		Percent		Mean		SD	
	IL	IM	IL	IM	IL	IM	IL	IM
Online-hybrid	413	246	28.5	85.9	1.16	1.10	.375	.313
F2F-blended	630	297	43.4	35.6	1.09	1.15	.295	.359
Control	408	291	28.1	34.9	1.06	1.15	.253	.365

Intermediate-low (IL) and Intermediate-Mid (IM)

R.Q.2: Does student listening comprehension strategy use develop over time without explicit instruction? Data from Table 1 revealed a metacognitive strategy use development for participants in the online-hybrid courses (83% for intermediate-low learners and 89% for intermediate-mid learners), but not development for the use of cognitive strategies (17% for intermediate-low learners and 11% for intermediate-mid learners). Data from the F2F-blended and control groups revealed a cognitive strategy use development (8% and 7% for intermediate-low and 15% and 16% for intermediate-mid), but not development for metacognitive strategies (90% and 93% for intermediate-low versus 85% and 84% for intermediate-mid learners). Results from Table 2 and ANOVA also indicated a development over time for cognitive strategy use with the face2face-blended and control groups. The means in Table 2 indicate that all instructional and ability groups seem to use more often metacognitive than cognitive strategies.

R.Q.3: Does providing redundant information in listening texts facilitate student use of certain strategies?

Table 3. Frequency for strategy types among instructional and ability groups

Strategy types	Frequency Control (IL)	Frequency OH (IL)	Frequency F2F-B (IM)	Frequency OH (IM)
2.Global prediction	3	11	3	8
4.Substitution	22	4	3	4
7.Directed attention	101	55	68	45
8.Selective attention	54	35	32	41
9.Double check monitoring	28	39	39	24
11.Performance evaluation	8	42	17	10
12.Problem identification	30	15	6	2
13.Comprehension monitoring	5	1	1	0
14.Translation	1	3	5	4
16.Note-taking	2	0	1	0
17.Summarization	4	21	13	4
18.Linguistic inferencing	10	12	2	1
19.Extralinguistic inferencing	2	20	14	15
23.Personal elaboration	3	4	4	0
25.Visual elaboration	3	4	5	2

Frequency counts for groups and levels of some strategy types

For intermediate-low participants one-way ANOVA was performed for strategy types among instructional groups. The assumption of homogeneity of variances was tested and rejected based on Levene's F test F (2, 1448)=9.07, p =.001. The Brown-Forsythe test was used for unequal variances and unequal sample sizes. This test revealed a significant difference in strategy types F (2,1285)=5.563, p = .004 among means (hybrid= 8.15, F2F-blended =7.31 and control=6.89) of the three instructional groups.

To study which group was different from another, the Games-Howell post hoc test was used because equal variance was not assumed. There was a significant difference between online-hybrid and control (mean difference 1.25, standard error.38, p = .003), but there was not a significant difference between f2f-blended and online-hybrid groups. When looking at the frequency counts for both groups with a statistically signicant difference the learners in the online-hybrid group use more cognitive strategies than learners in the control group.

However, the control group uses metacognitive strategies more frequently than its counterpart, such as direted and selective attention and problem identification.

For intermediate-mid participants one-way ANOVA was performed for strategy types among groups. The assumption of homogeneity of variances was tested and satisfied based on Levene's F test F(2,831)=.152, p = .859). The independent between-groups ANOVA yielded a statistically significant effect, F (2, 831) =3.27, p =.038, η^2 = .008. Thus, the null hypothesis of no differences between means was rejected, and 0.08% of the variance in strategy types was accounted for by groups (F2F-blended, control and online-hybrid). To evaluate the differences between the three means further, the statistically significant ANOVA was followed-up with three Tukey's HSD post-hoc tests. The difference between online-hybrid and F2F-blended groups was statistically significant p = .048, but there was not significant difference for the other groups. When looking at the frequency for both groups with a statistically signicant difference, it is clear that both groups use all strategy types, but the F2F-blended group uses twice as many metacognitive and cognitive strategies as the online-hybrid group.

5. Conclusions

Results from this study indicated that intermediate-low learners in an online-hybrid environment were perceived using more cognitive strategies than its counterparts. This was not unexpected because these learners are more accustomed to listening online without facial expressions, body language, kinesic information and perhaps are paying more attention to the tone of voice; therefore one could say that they have advantages over face2face-blended students for using cognitive strategies. Even if participants in this study were not explicitly taught listening strategies, data shows that learners use them. Moreover, they use more metacognitive than cognitive skills which is the key for L2 listening success (Vandergrift and Baker, 2015). The device of redundancy did not help participants using different strategies than their counterparts, but the frequency counts for cognitive strategies was evident for intermediate-low learners in the online-hybrid group. Perhaps the combination of instructional format and listening tests enhanced with redundancy helped to the use of more cognitive strategies.

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Collaborative creation between students and teachers for the development of an evaluation game board in class

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Abstract

Prehispanopolis is the result of a pedagogical, dynamic and innovative proposal for teaching, learning and evaluation of students through the creation of a board game developed between teacher and students. As part of the activities of evaluation, the students are proposed to create a game that involves the subjects and concepts of the course, and it can later be used as an evaluation tool.

The pilot test was conducted in the subject called Arquitectura Hispanoamericana (Hispano-American Architecture) of the Architecture program and limited to pre-Hispanic architecture and urbanism, hence the origin of the name of the game.

The main objective in the proposal of the creation of this game is to generate greater motivation and interest in students for learning in classes that have high theoretical content and are passive, monotonous and dense both in its content and in its class methodology. History of architecture meets these characteristics among students, for this reason it was decided to start with the project in this class.

Results show a high motivation and participation of the students, both in the development of the game and at the time of being used as an evaluation tool. Likewise, the academic results corresponding to the subjects evaluated with the game were improved.

Keywords: Boardgame; game-based learning; gamification; motivation; methodology.

1. Introduction and Background

Usually the theoretical classes use common techniques and methodologies for their development and teaching processes, among these are: the master class and presentations by the students. In this type of techniques, the person who is facing the students in the classroom, talking about the topics of the course, should have the ability to involve and capture their listeners, otherwise, this activity will be monotonous for the students. students. Likewise, in these theoretical classes, it is common to agree on forms of evaluation, which include: written exams (open question or closed question), exhibitions, written essays and portfolios.

These types of described situations are very commonly presented in history classes that are part of the curriculum of academic programs that tend to have courses with more practical content (workshop and laboratory), as they are usually in Engineering and Architecture.

Some of the current methodologies that support teaching processes and promote better learning are case study, project-based learning, problem-based learning, project work, inverted classroom and game-based learning (GBL).

Some of the tools available for the creation of games are: Kahoot, FlipQuiz, Quizizz or ClassDojo, with which it is possible to do an evaluation process, in which the students get involved in the class with the available technology in the questionnaire solution.

According to (Verdú Surroca, 2016) the learning methodologies are not isolated but are interrelated among them. In this way, the games can enhance collaboration through consensus among the members of the group, which must deploy the skills of exchange of ideas, opinions and knowledge, tolerance with the ideas of others, the elaboration and contribution of new knowledge, the negotiation of emerging perspectives and ideas and decision making.

Educational history games can be used as an alternative so that learning history is a motivating experience (Nor Azan, Azizah, & Wong Seng, 2009). Teacher designs the mechanics, dynamics and components creating scenarios and narratives to make learning attractive, combining teaching strategies in which you can use both physical and virtual tools.

Apart from the above characteristics, the learning based on the game are designed specifically for learning with favorable points such as: real-time feedback, socialization, the development of creativity and the promotion of participation.

Having the above mentioned, a proposal was developed that included the use of a board game for the evaluation of the History of Architecture class, specifically in the area of prehispanic architecture and urbanism, but that later evolved into a methodological

proposal that includes the participation, proposal, creation and testing of a game by students, including the concepts and topics that must be evaluated.

2. Project: Creation of a board game

The History of Architecture class has three evaluations during an academic semester. As an activity for the first evaluation, the students were proposed to create a board game, which could evaluate the topics corresponding to the architecture and urbanism of the main pre-Hispanic cultures of America, such as: Maya, Azteca, Inca and Tayrona, along with some of its cities, among them: Uxmal, Chichen Itza, Tenochtitlan, Teotihuacan, Cusco, Machu Picchu and Ciudad Perdida ("Lost City").

The creation of a board game was proposed, to be played within the class, as a learning tool, in such a way that there would be more interaction among the students themselves, that they would evaluate their classmates and discuss the answers, providing Real-time feedback

This idea was proposed with the aim of expanding the thematic content of the evaluation, increasing student participation, encouraging their motivation and involving them in the development of the evaluation activity.

In the elaboration of the educational game proposal several components must be taken into account, among them are: coherence between the theoretical, pedagogical, artistic and design components. For this development have taken into account techniques, dynamics and application of gamming concepts (Cortizo Pérez, et al., 2011), which is a design tool that contributes to meet the proposed objectives, for the case of learning, can help to obtain better results by obtaining rewards, points, prizes, challenges and classifications.

The basic dimensions of the gamification are three and are structured in a pyramidal way: - figure 1- the dynamics at the top, the mechanics in the middle and the components at the base (Werbach & Hunter, 2015).

Dynamics: They aim to satisfy the motivations of those who play to perform certain actions. For this, progress, recognition, rewards and status are used.
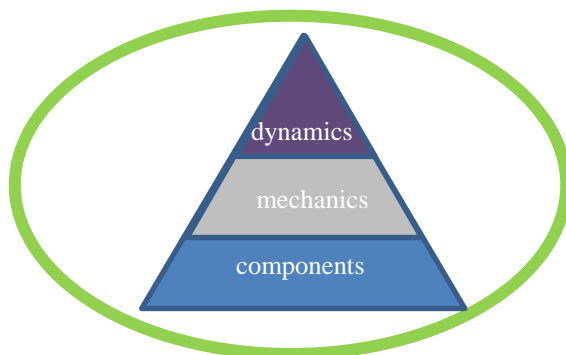
Figure 1. Dimensions of the Gamification. Source: Pisabarro Marrón & Vivaracho Pascual, 2018

Mechanics: Are the elements of the game that allow the participant to advance: rules of the game, control mechanisms, levels, points system, challenges, luck, competition, challenges, feedback, acquisition of resources, rewards, transactions, shifts.

Components: It refers to the objects that constitute the game, as well as the specific elements to materialize what is defined in the mechanics of the game. They include: avatars, badges, collections, content unlocking, gifts, scoreboard, levels, points.

Experience: It is the element that brings the game together and makes it feel real. They are the emotional responses during the development of the game, including fun.

3. Creation and design process

In the first phase of the board game project, the professor defines the topics that must be covered, in this case, the first part of the course was to be evaluated, these areas were: architecture and urbanism of the main pre-Hispanic cultures of America.

Afterwards the students meet to brainstorm about the type of game they wanted to create, based on the game they already knew. The result of this process oriented them towards two game proposals, similar to Monopoly and Parcheesi, but involving some modifications.

The next step was that, from a model given by the teacher, each group had to make ten study cards (cards with basic information about a specific topic - see figure 2.- which serve as study material) referring to the specific topics that should be evaluated, so that, based on the information in these cards, the teacher will create the questions. This activity allows students to study, summarize and learn more about the topics seen in class.

Later in a meeting with all the students without the teacher, an agreement was reached about the model of the game that would be used, defining: objective, instructions and key points for the development of the game. The document with all this information is sent to

the teacher for review and this is returned with the respective recommendations and observations, so that students have a corrected version for the next class.

Figure 2. Sample of Study card: god Chaac of the Mayan culture (In Spanish and translated into English).

In this stage the students are the ones who propose the game and define the rules, which allows that the game is not an imposition of the teacher, but they are part of the creation of this, which provided greater motivation, participation and identity within the group and the game. At the next meeting between all the students and the teacher, a review of the document is made, doubts are clarified, and the necessary adjustments are made.

Subsequently the activities of construction of the game are distributed. Each group has the responsibility to create and build the different parts that make up the game, such as the board, the chips, the cards, the box, the instructions with illustrations, etc. Before making the impression, all the material goes through the group's review, to make the respective recommendations. This means that, even though the tasks have been divided, everyone is involved, creators and participants in the materialization of the game.

Figure 3. Students playing during the evaluation activity.

Finally, the complete game is assembled, and the day of the evaluation is tested. The first part of the grade corresponds to the work done by each group for the creation of the game and the second part of the grade, corresponds to the performance that is held by the students during the game. Figure 3.

4. Results and evaluation

In this first version, the game consists of: 70 thematic knowledge cards (general, housing, urban planning, buildings and techniques), 70 question cards, 12 offering cards, 12 slaughter cards, 1 box, 1 board, 7 Totem poles, 2 dice, 1 pin box and the manual of rules. See figure 4.

The dynamics of the game consists in acquiring the greatest amount of properties and in turn occupying the territories on the map. Each player or group chooses a Totem (each Totem has the form of a god of each culture) places it in the center of the board that corresponds to Lost City, all players or teams roll a die and the player or team that has the highest number starts the game. Throw the dice again and the number that comes out indicates the path through which you must start, throws the dice again and indicates the number of squares to advance.

Figure 4. Components of the board game created and manufactured by students.

Each square has a color and you should take a question card corresponding to this color (green: cultural generalities, blue: urbanism, red: buildings, yellow: housing and purple: technical). If the answer is correct, the pawn stays in that square and earn the card and a pin, which must be located on the map, on the city corresponding to the question. If the answer is wrong, the pawn remains in the previous square without moving. The game ends when a player comes back to the same starting place by running the board clockwise. The player with the most pins and properties earned wins the game.

The dynamics of the game are complemented by some thematic knowledge cards, which can be used by the students, to review the topics before starting the game or they can also be used to verify the answers to the questions during the game, since the knowledge cards are associated with the question cards.

In the following chart, it is summarized how the moment of the game and the elaborated material contribute to the learning and feedback of the student.

Table 1. Summary of the stages of game creation, material used and learning objectives.

Moment	Use Material	Learning objetives.
Previous stage of the game	Thematic knowledge cards	• Remember historical facts of pre-Hispanic cultures. • Understand the differences and similarities of cultures through comparisons.
Stage of action of the game	Question cards	• Contrast what was learned in class and what was reviewed with the thematic knowledge cards, with the answer of the questions.
	Thematic knowledge cards	• In case of doubt, to be able to compare the answers of the other players or groups, with the knowledge cards, to decide if the answer is correct or not. (feedback).
	Bonus cards	• Evaluate the knowledge learned through questions and argumentation in the answers.

A survey was made to 47 students (two different years) about their experience with the board game and their learning after the class. The results are shown on table 2.

Table 2. Survey to the students about the experience and learning using the board game.

Your experience playing the game	★★★★★	4,61
To use board games in others classes	★★★★★	4,67
Knowledge after the class	★★★★½	4,49
Remembering stuff visiting these places	★★★★☆	4,36

During the development of the evaluation process it was evidenced that the learning by the students was greater due to the number of correct answers given during the game, likewise, in terms of grades there was an increase in the average of these. A good part of this increase is due to the fact that the development process of the game occupies 50% of the grade,

however, the remaining 50% of the grade, is still higher than the average of the previous years, going from 3,4/5,0 to 4,4/5,0.

Survey also asked to the students about their preferences on presentation of the topics, evaluations and exams. Results are shown on table 3 and table 4

Table 3. Survey to the students about the experience and learning using the board game.

🔵	Teacher's presentation	17,0%
🟠	Student's presentation	2,1%
🟢	Using board game	80,9%

Table 4. Survey to the students about the experience and learning using the board game.

🟠	Written Exam.	10,6%
🟢	Online tool.	46,8%
🔴	Using board game.	42,6%

On the other hand, we proceed to perform the t-student test to check the equality or statistical difference of the samples of the students' averages, according to the grades when the board game was used as a tool to teach the topics in class or it was not, in class but it was not used to take grades. Taking as null hypothesis $H_0:\mu_1 = \mu_2$, when performing the respective calculations we obtain the computed p-value is lower than the significance level alpha = 0.05, one should reject the null hypothesis H_0, and accept the alternative hypothesis $H_1:\mu_1 \neq \mu_2$. With which it is possible to be affirmed that if there is an improvement in the average of final marks of the students who have been evaluated using the board game as a teaching tool.

5. Conclusions

The board game created with the students is highly satisfactory, since it fulfilled the objectives of increasing the participation and motivation of the students in the History of Architecture class. Likewise, both in appreciation and as a result of the notes, an increase was obtained in the correct answers and in the quality of these. Students enjoyed the experience with the board game.

Although the game fulfilled the objectives during the test, after its evaluation several physical, regulatory and structure aspects were found that must be modified or restructured,

so that other teachers of the class can be used or adapt it to other courses. At this moment we are working on that correction and update process.

When replicating the game with other students who had not participated in its construction, some doubts and inconsistencies were presented, since they did not know the game. Likewise, in order to involve the students more, some activities should be added, in which the students can choose the modification of some of the rules for the evaluation.

By involving students in the design of the game and giving them freedom for their development and creation, a close follow-up must be done so that the objectives proposed by the teacher are achieved and not only the creation of a game.

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Modern Pedagogical Approaches to Teaching Mixed Methods to Social Science Researchers

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Abstract

Mixed methods research is burgeoning across the social sciences. Yet there is a need to implement more modern approaches to teaching it in higher education. The aim of this work is to outline pedagogy and preliminary evaluation of new mixed methods workshops designed and implemented in an Australian university. A specific feature of these workshops included unpacking the ontological, epistemological and axiological understandings of various methods and the paradigms or worldviews that underpin each approach. This overview of the processes of scientific inquiry that permits mixing-in within and across quantitative and qualitative research designs aims to help participants to see how logics moved among these divides. In order to engage participants in critically learning about these abstract concepts, we adopted teaching strategies of flipped classroom and active learning. Results, from the workshop evaluations and individual learning reflections, provided preliminary evidence that: (i) due to this broad overview on mixed methods, participants would likely use mixed methods in the future in their field; and (ii) there is a strong appetite for high quality Mixed Methods instruction in higher education.

Keywords: Mixed methods; flipped classroom; active learning.

1. Introduction

Mixed methods (MM) research has increased over the past four decades, with noted growth within the social sciences and associated disciplines including business, education and health (Brannen, 2005; Creswell & Plano Clark, 2011; Fetters, Curry & Creswell, 2013). This expanding MM research community has led to the establishment of two journals in the past decade or so (*Journal of Mixed Methods Research* in 2007 and the *International Journal of Multiple Research Approaches* in 2009), and a compendium of scholarly discussion on MM (Hesse-Biber & Johnson, 2015). Nevertheless, MM is not perceived as a panacea nor a quick solution. As noted by e-blogger Gargani, '*A mixed-methods design explicitly lays out a thoughtful, strategic integration of qualitative and quantitative methods to accomplish a critical purpose - that either qualitative or quantitative methods alone could not*'(evalblog.com, 2012*)*. Indeed, mixing methodologies requires knowing about both quantitative (quant) and qualitative (qual) methods, but also encompasses knowing how to combine them effectively.

Hence we propose that it can be an advantage, for researchers new to mixing of methodologies, to learn about the general principles and widespread practical issues involved in combining or integrating methods, either within or across quant and qual components of the research design (Brannen, 2005). This means planning how to connect, build or merge their research questions, conceptual frameworks, data and their analyses in meaningful ways (Fetters, Curry & Creswell, 2013; Ivankova & Plano-Clark, 2018; Low-Choy, Riley & Alston-Knox, 2017, Section 4). An advantage of MM is that it provides researchers a 'new framework for thinking' about complex phenomena in the social sciences (Fetters *et al.*, 2013, p.2151). However, it also presents a challenge for instructors wanting to expose new researchers to a multiplicity of methods (Anguera *et al.*, 2018). Furthermore, this challenge is heightened when 'there are few instructors with the social research methods community who possess the theory/methods skills to teach such a course effectively' (Hesse-Biber, 2015, p. 475). Currently, the challenge, for learners and teachers of MM, is that pedagogical practice around how to teach MM is still developing (Ivanokova & Plano-Clark, 2018). Here we document our initial efforts to develop MM pedagogy in an Australian university. Despite the growth in MM uptake, including among research higher degree students, relatively few courses, that address this content specifically, are offered across universities in Australia[1]. This points to a perceived vacuum in the 'pedagogical culture' in regards to MM instruction in higher education (Hesse-Biber, 2015, p.463). The reasons behind an apparent dearth of MM courses and teaching in Australian higher education would require an investigation that is beyond the scope of this paper. However, some evidence suggests that differing traditions

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[1] A 10 tab Google search 'mixed methods courses Australia' found 7 courses across Australian universities including ANU, Curtin University, UNE, UOM, The University of Adelaide, Monash University, and The Unviersity of Western Australia.

and paradigms of quant and qual inquiry mean that researchers and/or instructors tend to become experts in either qual or quant methods, rather than both (Hesse-Biber, 2015, p. 464). While researchers may claim they are mixing methods by designing surveys that comprise both closed and open ended questions, we argue MM requires much deeper thought and investment.

Our workshops reflected our belief that mixed methodologists also need to carefully consider philosophical questions around ontology, epistemology and axiology that shape underpinning research paradigms (Morgan, 2007). The need to discuss such "ologies" is usually mandatory for qual researchers (Brannen, 2005). However, for quant scholars this philosophical aspect is becoming more necessary due to the growing multiplicity of modern statistical paradigms, yet quant practitioners are typically poorly prepared with little or no exposure to philosophy of science, except at a cursory level (Low-Choy, *et al.*, 2017, Section 8.6). Consequently, many qual practitioners view quant methods as solely "positivist" (Patel, 2015), a perspective that appears rooted in experiencing quant methods purely from the perspective of null hypothesis significance testing (Low-Choy *et al.*, 2017, p.318). In contrast, when deciding to mix qual in with quant methods it then apparently becomes "abruptly" important to make explicit the paradigms or worldviews that inform the research design. Thus unfortunately, the examination of "ologies" and the different research paradigms is often omitted from the process of MM research (Alise & Teddlie, 2010; Shannon-Baker, 2016). For this reason, our workshops make it a priority to communicate that "the what and the why of MM are logical steps to consider before deciding how it should be done". Therefore, these three elements (what, why and how) were adopted as the framework for a series of three half-day workshops, developed and delivered by the authors to introduce mixed methods. The audience comprise researchers predominantly from social, behavioural and environmental sciences, as at a university in Australia in 2018.

2. Developing a Pedagogy for Mixed Methods

Designing mixed methods workshops from scratch involves working out: (1) content (what, why and how); (2) workshop timing and sequencing; (3) strategies for teaching and learning (e.g. active learning, small group work); and (4) an evaluation. The first workshop unpacks the main "ologies" – Ontology (*What is MM?*), Epistemology (*How is MM approached?*), Axiology (*Why and When is MM valuable?*) and Methodology (*Which way is MM implemented?*). These define the foundational knowledge needed to inform a mixed methods approach, and therefore provide an important basis for participants to critically read about, discuss, explore and consider multiple methods. Then, we explored the continuum of paradigms and associated "isms" (e.g. constructivism, positivism, pragmatism) that span qual, quant, and mixed research approaches. This drew on definitions of a paradigm as 'a set of beliefs, values and assumptions that a community of researchers has in common' (Johnson

et al., 2007, p. 129), and, 'systems of beliefs and practices that influence how researchers select both the questions they study and the methods they use' (Morgan, 2007, p. 49).

Next, we presented content on research inquiry by examining hypothetico-deductive, inductive and abductive reasoning and demonstrated how these logics may operate within MM research. Here, we introduced workshop participants to a pragmatic worldview that slides between inductive and deductive logics (abductively), and illustrated this concept by presenting a sequential mixed methods (qual + quant) research design (Morgan, 2007; Feilzer, 2010). Arguably, such 'pragmatism offers several ways to bridge dichotomies that exist in mixed methods approaches to social science' (Shannon-Baker, 2016, p. 325).

The second workshop focused on the importance of, and techniques for, developing a conceptual framework that could support either qual or quant methods, in a way that clarifies and distances the concepts (and variables) as distinct from the measurement approach (which may be qual or quant). Akin to mind-maps (Wheeler, 2010), these conceptual maps powerfully allow researchers to summarize their research question and also provide an interim step towards visual quantitative methods (Low-Choy *et al.*, 2017, Section 8.1). Similarly, scientific method can be viewed holistically using a structure amenable to representing the process of either qual or quant research, involving: research questions, conceptual model, empirical model, design of data collection, its analysis through to interpretation of results, and overall findings. An exercise helped researchers: identify the current stage of their research; understand the cyclical nature of the research inquiry process; and hence begin to differentiate the purpose of different (qual or quant) methods, e.g. for pioneering work (with main innovation in mapping concepts) or confirmation (with main innovation in collating new evidence). The workshop provided examples of how these conceptual, pre-quantitative maps could underpin mixed methods research, e.g. combining Structural Equation Models (SEM) or Bayesian statistical modelling with interpretative analysis of interviews (Low-Choy *et al.*, 2017, Section 5). An exercise prompted participants to draw draft a conceptual map underlying their own research.

The third workshop demonstrated options for the sequencing and mixing in, between, and across of quant and qual components of a research project (Anguera *et al.*, 2018; Creswell & Plano-Clarke, 2011). This included the foundational concepts of choosing what evidence to provide, e.g. via sampling or case studies (Onwuegbuzie and Collins, 2017, p.139). An exercise engaged students in identifying typologies of mixed methods designs (e.g. concurrent, embedded, triangulation) and extended this learning to their own projects. Here, issues of the mixed method goal, rationale and purpose were revisited along with an emphasis on research paradigm, acknowledging that paradigms are not static entitites but moveable frames (Shannon-Baker, 2016). To consolidate these ideas, participants engaged in small group discussions, helping learners distinguish between multi- and mixed-methods in their own research projects. A capstone activity showed examples, then invited participants to

investigate ways to triangulate findings amongst qual or quant components of a MM study, e.g. corroboration, elaboration, complementarity and contradiction (Brannen, 2017, p.176).

3. Mixed Methods Workshop Implementation

On registration, the 58 participants were informed about and hence subscribed to the pedagogy we chose, which was designed to facilitate critical learning about abstract notions of philosophy through the structure, sequencing and format of our three MM workshops.We adopted a 'flipped classroom' approach, by setting readings (of 1 or 2 papers) for each workshop. An active learning approach required participants to undertake activities in small groups (e.g. brainstorming, concept mapping, sketching strategies for triangulating evidence). This 'hands-on approach' to teaching MM has been endorsed by Hesse-Biber (2015) who suggests it is important that students have opportunities to practice, share and reflect on MM challenges and issues. From our perspective, this prepares participants to continue to learn about and apply MM beyond the workshop.

For workshop evaluation and assessment of knowledge and learning we used a MM approach, via a survey tool (implemented in Qualtrics, and accessible by personal devices) Closed and open-ended questions sought to determine: participants' attitudes and expectations of MM including prior use, and projected usefulness, of MM methods within their own research. We obtained 15 respondents to questions delivered electronically during class (n=9) or afterwards (n=6), yielding a response rate of about a half. Since workshops are delivered free-of-charge, we typically experience an attendance rate of 50-90% compared to those who registered. Due to the small sample, these figures are indicative only.

4. Quantitative Feedback

Only 8 respondents answered the question on how useful they thought mixed methods would be for their own research, with all selecting "extremely" (n=3), "very" (n=4) or "moderately" (n=1) useful, meaning it would be of benefit to "all", "most" or "half" of their research projects. Interestingly no responses ranked MM as being less beneficial, aligning with the growing perceived relevance of mixed methods in doctoral theses in the social sciences (Creswell & Plano Clark, 2011).

We also received 9 responses to rate how likely it would be that they would use MM in the future: between 0 (not likely) and 10 (highly likely). A mean rating of 7.71 showed that on average, this was quite likely. About a quarter of the respondents were not sure (ratings of 3-4 in Education and Archaeology), nearly half were adamant (4 ratings of 10 in Psychology, Business, Cultural Heritage, Health), and a third considered it moderately likely (3 ratings between 6 and 8 in Business, Social Work). On a related note, there were a further 13

responses to the post-course administrative surveys. Ratings for usefulness of each MM workshop, ranged from: extremely (5 ratings of 10 in Arts/Education/Law, Business, Health, Science), highly (6 ratings of 7 to 9 in Business, Health, Science), moderately (1 rating of 5), to a little (2 ratings of 2-3 from Health, Science). The lowest ratings were made by participants who were very early in their PhD candidature.

5. Participant Reflections and Qualitative Feedback

In the MM course individual participants were given the opportunity during each workshop to reflect on their learning, with options to share these among a small or whole group. This included discussing "lightbulb" moments and "take-home" messages. Feedback was collected post-workshop by the administrative team responsible for logistics. We were able to appraise the open-ended comments left by a cross-section of respondents; some examples of high-level feedback are Examples 1 and 3 in Figure 1. Indeed, feedback was predominantly positive across different fields, and confirmed that this was typically the only training that any researchers had encountered on MM. (See Figure 1).

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1. *"This is the most useful methods course I have ever attended. Thanks!" (Academic Staff)*
2. *"I had pretty simplistic notions of MM research unpacked a bit – 1) that the reason for a second method will vary depending on the phase of research at which it is introduced, 2) that MM research can be thought of in terms of a continuum, with one or other dominant or of equal status" (HDR Student)*
3. *"It is good to revisit the variety of methods in a specifically mixed-methods context" (HDR Student)*

Figure 1. Mixed Method Workshops Feedback

Constructive feedback was specifically sought separately, and often indicated the course was sufficient to their current needs. Equally often, however, there was a desire for more: establishing a community of practice; a longer workshop to provide more examples or more comparisons (e.g. qual vs quant components, or good vs poor examples); more literature; or further workshops on different topics. The most common verbal feedback during class was a request for a workshop on how to write up mixed methods research.

6. Discussion and Conclusion

Mixed methods research is a growing methodological option for researchers across the broad range of social sciences. We designed MM workshops that invited participants to delve into the foundations of mixed methods and why they would use them, from a modern perspective. We advocate a new kind of MM pedagogy that introduces the idea that qualitative and quantitave approaches, and their logics of inquiry, can be, and often are, integrated or woven into and throughout the entire research process (Brannen, 2005; 2017). By making the logic

of scientific inquiry central to the series of workshops on MM, participants were able to understand that mixing-in can occur within or across quantitative and qualitative analysis. Furthermore, we aimed to provide a more general appreciation of the research process (qual, quant or mixed) by highlighting the central role of mapping concepts and considering the role and logic of evidence (provided by any method) within the framework of scientific method. Participants were introduced to the philosophical ways of knowing or "ologies" and invited to explore the different paradigmatic positions that underpin the research process, and shown how this could help select and justify choice of a particular MM.

In conclusion, recent work has begun to revisit the question of whether it is possible to mix or integrate data, referring to the potential messiness of untangling ontological and epistomoglogical assumptions when methods are mixed (Uprichard & Downey, 2016). Finally, a 'more thorough "mixing in" of qualitative and quantitative components of analysis' as suggested in recent literature (e.g. Low-Choy *et al.*, 2017, p. 318) may work to break down the persistent stereotypes and assumptions associated with each of these approaches. Pedagogically, student-engaged learning approaches that guide the unpacking of complex mixed methods issues may assist those new to MM to gain a better understanding of MM (Hesse-Biber, 2015; Invankova & Plano-Clark, 2018). Finally, we suggest continued scholarship is needed in the area of mixed methods teaching and pedagogy within and across higher education institutions.

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Future of Higher Education: Emotionally Intelligent and Mindful?

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Abstract

The purpose of this study was to investigate the effect of using the RESET model on Emotional Intelligence, Resilience, and Empathy of students registered for a software engineering senior capstone computer science course. Thirty-seven undergraduate students participated in this study during 2017-18 academic year. The participants were taught emotional intelligence and mindfulness skills encompassed by the RESET model. Most of the students completed both Pre and Post EQi 2.0 and Connor-Davidson Resilience (RISC-25) scales. Our results indicate statistically significant pre to post changes in overall emotional intelligence $t(32)=3.071$, $p<.004$, empathy $t(32)=4.143$, $p<.0001$, and resilience $t(24)=2.366$, $p<.026$. This quasi experiment is the first step in assessing the efficacy of the RESET Model in higher education. More controlled experiments will follow. These results support the notion that mindfulness practices coupled with emotional intelligence training lead to increases in resilience, overall emotional intelligence and empathy in college students.

Keywords: *Emotional Intelligence; Higher Education; Mindfulness; Software Engineering; Empathy; Resilience.*

1. Introduction

The purpose of this study was to investigate the effect of using the RESET model on Emotional Intelligence, Resilience, and Empathy in a software engineering senior capstone computer science course.

Agile software development is a methodology used where the emphasis is on creating usable code as quickly as possible. This software development method allows software engineers to quickly change direction due to changes in customer requirements. Students in a full year capstone Software Engineering course worked closely with an outside client to develop original software. In this capstone experience creative solutions evolve through close collaboration of self-organizing teams using the agile software development methodology. This approach puts a premium on communication and teamwork (Cotler, et al., 2017; Singh, Singh, & Sharma, 2012). Part of our paradigm integrated into our agile development practice is emotional intelligence (EI) to help foster the growth of these critical skills. Mindfulness which correlates with the growth of the main pillars of EI was used in the study as a foundational construct (Cotler, et al, 2017).

EI has been largely defined by the construct that has been developed, validated, and used to measure it. In the study presented in this paper the EQi 2.0 Model was used to assess the five foundational components of EI. These include self-expression, self-perception, stress management, decision making, and interpersonal skills. Much of the research in the area of EI in higher education has been focused on whether students possess these skills (Bonesso et al.2013; Davidson, 2012). At the same time, fewer studies have discovered how undergraduate students' EI can be improved and what evidence based curricula are most effective in fostering development in these areas (Alexander, 2014; Bonesso, et al. 2013; Conley, 2015; Lin, Lee, Hsu & Lin, 2011; Pool & Qualter, 2014; Salami, 2010).

2. Emotional Intelligence: Definition and Importance in Higher Education

The publisher of the EQ-1 2.0 model, Multi-Health Systems (MHS, 2019) defines Emotional Intelligence as a set of emotional & social skills that influence the way we perceive and express ourselves, develop and maintain relationships, cope with challenges and use emotional information in an effective and meaningful way. The exciting aspect of EI is that unlike IQ and personality it is something that can be learned and developed (Goleman, 2004). Multiple studies have shown the importance and benefits to higher education students of developing these EI skills such as better grades (Nelson & Nelson, 2003, Zeidner et al., 2009), increased workplace performance especially when working in teams (Bradberry, 2014; Eswara, 2019), leadership talent (Bradberry, 2014; Goleman, 2004, 2013; Goleman et al., 2013), overall job satisfaction (Sener, Demirel, & Sarlak, 2009), and increased earning potential (Bradberry, 2014; Momm, Blickle, Liu, Wihler,

Kholin, & Menges, 2014). Students graduating with these skills are often sought after by employers especially in technical organizations (Bradberry, 2014; Majid & Mulia, 2011). For example, Google relies more on EI then grades or school attended when interviewing candidates for positions (NACE, 2015; Thygesen, 2014). Only 42.5% of the employers that were surveyed in Job Outlook 2018 reported that graduating students have the necessary emotional intelligence skills (professionalism) necessary to succeed in the workplace (NACE, 2018). These findings highlight the importance of teaching these critical skills to undergraduate college students. While evidence highlighting the importance of emotional intelligence to undergraduate students continues to grow, the perception of employers is that students are not graduating with these skills (NACE, 2018), primarily because they are not being taught as part of their undergraduate experience (Beard & Schwieger, 2008; Jobes, 2015; Scott-Bracey, 2011).

2.1. Influence of Mindfulness on Emotional Intelligence

Shapiro et al (2015) describe mindfulness as "bringing full awareness into the present moment." Researchers continually report the multiple benefits of mindfulness practices, many of which have a positive relationship with EI (Brown & Ryan, 2003). Regular mindfulness practice strengthens the ability to understand our own emotions (Brown, Ryan, & Creswell, 2007), to regulate and control emotions (Cahn & Polich, 2006), and develop the ability to detect and understand the emotions of others (Brown et al., 2007). Further, due to neuroplasticity, mindfulness practices have been shown to change the composition of the brain (Tan, 2012). One study using magnetic resonance imaging pre-post a mindfulness program found positive changes in the mindfulness group when compared with the control group, in locations of the brain involved in functions important to EI such as emotional regulation, self-referential processing, and perspective taking (Hölzel, Carmody, Vanqel, Congleton, Yerramsetti, Gard, & Lazar, 2010).

3. The Study

3.1. Participants

This study was conducted in the capstone software engineering course during the 2017 - 2018 academic year. This study was conducted at a small liberal arts college (approximately 3,200 students) and included 37 undergraduate students enrolled in a full-year senior capstone software engineering course. All students were computer science majors in their final year of study, where thirty were male (81%) and seven were female (19%).

3.2. Instruments

The EQi 2.0 assessment tool was selected to measure emotional intelligence at the start of the fall semester 2017 and again at the end of the spring semester 2018. This psychometric assessment tool has strong internal consistency ($\alpha = .69 - .86$) and test-retest reliability (1-month $r = 0.85$ and 4-month $r = 0.75$). Further, this instrument is used widely (over one million world-wide) and offers a comprehensive individual student report with feedback with strategies for enhancing personal EI skills (MHS, 2019). The instructor of the software engineering course is a certified practitioner of EQi 2.0.

The Connor-Davidson Resilience (RISC-25) scale was used to measure resilience. According to Davidson JRT (2018), CD-RISC has been validated and successfully used in multiple experimental studies. This measure has a high predictive validity and high test-retest reliability ($r = 0.87$). SPSS was used to perform the statistical analysis.

3.3. Procedure

All students were pre-tested for both EI and Resilience using the EQi 2.0 and Connor-Davidson Resilience (RISC-25) scales respectively. Integrated directly into the curriculum for this full-year course were experiential emotional intelligence interventions using the RESET model (Recognizing and regulating Emotions through Social and Emotional Team-based learning supported with mindfulness), (Cotler, 2016; Cotler, et al, 2017). Based on the RESET model, mindfulness was integrated directly into the start of class and was followed up with an assignment for individual practice outside of class. At the end of the year, all students were post-tested for both EI and Resilience using the EQi 2.0 and Connor-Davidson Resilience (RISC-25) scale.

4. Results

The results of the study showed statistically significant growth in the areas of student resilience, overall emotional intelligence and empathy. As shown in Table 1, the following results were obtained for Connor-Davidson Resilience scale. The mean (M) of 75.40 with the standard deviation (SD) of 11.979 was observed for pre-test while M=79.92 and SD= 12.265 was observed for post-test condition. A paired samples t-test was conducted to analyze the differences between pre- and post-tests and resulted in a t(24)=2.366, p<.026, indicating statistically significant increase in resilience between the pre-and post- test. EQi 2.0 scores resulted in the M=104.55 with SD=13.024 for the pre-test and M=110.30 with SD=15.306 for the post-test condition. A paired sample t-test yielded a t (32)=3.071, p<.004, indicating statistically significant increase in EQi 2.0 scores from pre to post-test. A statistically significant increase was also observed for Empathy scores with a t(32)=4.143, p<.0001 and corresponding M=107.06, SD=13.246 for pre-test, and

M=114.58, SD=9.418 for the post-test. These initial results support the notion that mindfulness practices coupled with emotional intelligence training leads to increases in resilience, overall emotional intelligence and empathy in college students.

Table 1: Quantitative Results

Measure	Pre Test	Post Test	t-test results
Connor-Davidson Resilience Scale	M = 75.40 SD = 11.979	M = 79.52 SD = 12.265	t(24) = 2.366 p < .026
Overall EQi 2.0 Scores	M = 104.55 SD = 13.024	M = 110.30 SD = 15.306	t(32) = 3.071 p < .004
Empathy Scores	M = 107.06 SD = 13.246	M = 114.58 SD = 9.418	t(32) = 4.143 p < .0001

4.1. Sample Student Reflection

As a student who has completed two computer science classes that incorporated mindfulness and emotional intelligence into the course, I have noticed a difference in my mindset towards creating software. In the fall semester of 2018 I was enrolled in two of these courses, Human Computer Interaction (HCI) and Software Engineering I. In the beginning of the semester every student took the Myers-Briggs Type Indicator, an EQi 2.0 assessment and had a meeting to discuss our individual results with our instructor. I used this experience to self reflect, understand other personality types and learn how to design considerate software. Throughout the course we were taught how to build empathy with target users to understand their specific needs and goals. We were also taught how to design for different personality types and even users with disabilities.

Along with improving my emotional intelligence, I also practiced mindfulness. At the beginning of almost every class in HCI we spent a couple minutes doing a reset meditation where our instructor would guide us to concentrate on an anchor, sometimes our breath or sometimes an outside noise. Being a college student where it's hard to relax during the semester, these couple minutes before class were appreciated to just take a second to breathe and collect myself. I found myself more relaxed and focused for the rest of the class on the days we practiced meditation than the ones we did not.

Understanding and developing my emotional intelligence and practicing mindfulness has not only changed my professional attitude when designing software but it has also bled into my personal life. I have become more aware of other's emotions and give gratitude more often than I was before taking these computer science courses.

5. Discussion

Our results point towards potential effectiveness of the RESET model in higher education, and specifically in computer science. These results support the notion that mindfulness practices coupled with emotional intelligence training may lead to increases in resilience, overall emotional intelligence and empathy in college students. The authors would like to note that this is a quasi experimental study with no control group. This type of research is very difficult but important to conduct as it is limited by curriculum structure in the U.S. where it is rare to have students enrolled in a one-year long undergraduate capstone courses. There are also important gender and personality type variables (Reynolds, et al., 2016) that may have played a role in this study and make our results even more noteworthy. The Computer Science major in the U.S. has one of the largest gender disparities across science, technology, engineering and mathematics (Master, et al., 2016). In this male dominated field, often characterized by students who choose it because they are more comfortable interacting with machines than with other people (Cheryan, et al., 2015) seeing such a dramatic pre to post improvement in EI and empathy scores for such students is very encouraging. Therefore, despite some methodological limitations, this experiment is an important step forward in demonstrating the model's potential impact on higher education.

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Building a Culture of Critical and Creative Thinking. Creating and Sustaining Higher-Order Thinking as part of a Quality Enhancement Plan

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Abstract

The TH!NK initiative at North Carolina State University seeks to bridge the gap between evidence-based research on teaching and actual teaching practices in the classroom. Through this work, the culture of teaching and learning on our campus is being transformed from teacher-centered to student-centered instruction that promotes higher-order thinking across a diverse array of disciplines. Participating faculty engage in intensive faculty development; create discipline-specific classroom activities and assignments; become adept at providing students feedback on their thinking skills; and engage in a learning community to share and provide peer feedback on pedagogical innovations. The primary student learning outcome (SLO) is for students to apply critical and creative thinking skills and behaviors in the process of solving problems and addressing questions. Methods to achieve the institutional transformation include implementation of comprehensive faculty development focused on the use of evidence-based pedagogy that promotes higher-order thinking and rigorous outcomes assessment to provide means for continual improvement. The program has expanded into multiple phases, and involves strategies to create a more sustainable culture of critical and creative thinking through formal and informal learning and scholarship.

Keywords: higher-order thinking; quality enhancement; critical and creative thinking; program development; teaching strategies.

1. Background to the Quality Enhancement Program

At North Carolina State University, we have seen increasingly higher standardized test scores and grade point averages in our incoming students. At the same time, our alumni report that they were not fully prepared for career challenges related to critical and creative thinking. This gap was the driving force behind NC State's 2014 Quality Enhancement Plan, focused on enhancing higher-order thinking skills, including both critical and creative thinking, as a core part of both formal and informal learning throughout the University.

Robert Ennis (1995) defines critical thinking as reflective and reasonable thinking that is focused on deciding what to believe or do. He argues that critical thinking is a practical activity that includes creative actions such as raising questions, formulating hypotheses, generating alternatives, and gathering information. Popular frameworks that are effective in describing the evaluative nature of higher-order thinking often do not touch deeply on the creative aspects (Paul and Elder, 2012). Roger Martin, Dean of the Rotman School of Management at the University of Toronto, argues that critical *and* creative thinking are critical to the future of work and economic prosperity. He describes a long-term statistical trend away from routine-oriented work, which emphasizes rote learning and repetition, and toward more creativity-oriented jobs that emphasize critical analysis and making judgments (Martin, 2009, p.5). A 2012 IBM study of over 1,700 CEOs also reflects the changing nature of industry when reporting that the top 4 traits desired in the contemporary workforce were collaboration, communication, creativity and flexibility (Leading Through Connections, 2012, p.21).

2. The TH!NK Program

The NC State Quality Enhancement Plan, TH!NK, initially focused on training faculty teaching courses that serve primarily first-semester freshmen. It has since expanded to include faculty teaching courses at all academic levels, vertical integration through majors, faculty scholarship programs, and a teaching strategy database and resource sheets. The faculty training program seeks to bridge the gap between evidence-based research on teaching and teaching practices in the classroom. Through this work, we aim to transform the culture of teaching away from teacher-centered instruction and toward student-centered instruction that promotes higher-order thinking.

Participating faculty engage in intensive faculty development and create discipline-specific activities and assignments that utilize evidence-based pedagogical strategies that impact student higher-order thinking. They become adept at providing students feedback on their thinking skills, rather than just their final work products. They engage in a learning community where faculty share and provide peer feedback on pedagogical innovations and are supported in publicly disseminating pedagogical innovations.

The primary student learning outcome we aim to achieve through the initiative is for students to apply critical and creative thinking skills and behaviors in the process of solving problems and addressing questions. Figure 1 illustrates the creative process, encompassing criticality and self-reflection, as we have defined it. Defining these skills explicitly not only helps students, but helps faculty mentors focus on building scholarship in the students. This process aligns directly with our student learning outcomes and our methods of assessment.

The key skills and behaviors we focus on are raising questions and formulating problems; gathering and assessing relevant information, synthesizing and generating ideas, considering alternatives, reaching reasoned conclusions, effectively communicating and reflecting at each stage of the process.
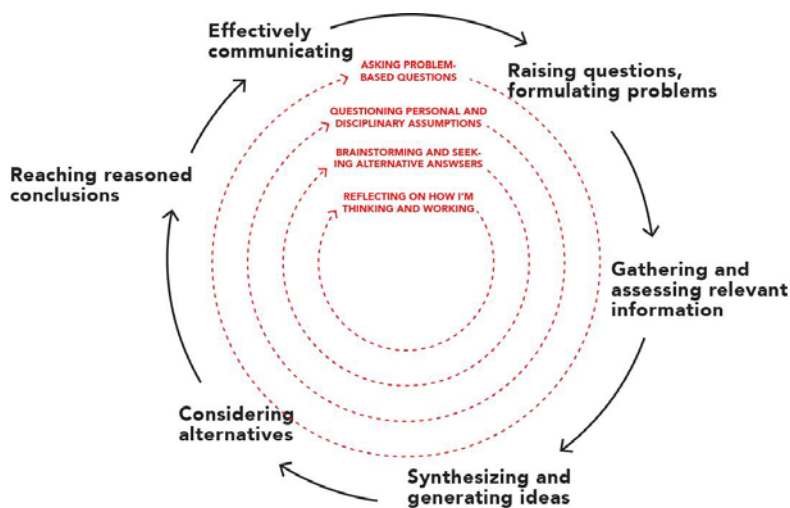

Figure 1. The critical and creative process.

2.1. Program Structure

The TH!NK initiative utilizes a peer mentoring model. The implementation team consists of a Director who is a faculty member in a STEM discipline and was engaged in the scholarship of teaching and learning prior to her directorship, four rotating TH!NK Fellows who are active faculty members and receive one course buy-out and $5,000 additional compensation annually, half-time administrative support, as well as support from the Office of Assessment and the Office of Faculty Development. The Director and Fellows are responsible for workshop and resource development, as well as peer mentoring support as participants work on their course enhancements. The Office of Assessment is responsible for student learning outcomes assessment, and the Office of Faculty Development assesses our workshops and faculty learning.

2.2. Faculty Development Plan

Approximately thirty faculty members are recruited to the TH!NK Faculty for training and participation each year. The intensive TH!NK Institute takes place in May, the week following commencement. TH!NK Faculty work on course revisions over the summer with the support of their interdisciplinary peer cluster consisting of other TH!NK Faculty and a TH!NK Fellow, and we reconvene in August prior to the start of the semester for faculty to share out their pedagogical innovations and to receive structured peer feedback.

The primary goal of the May institute is to define the critical and creative thinking process across disciplines and provide faculty with tools to create opportunities for students to practice the skills in the process, as well as tools to provide feedback on students' thinking process in addition to their work product. Topics that faculty engage with in the workshops include: stages of epistemological growth (Perry, 1981; Paulesen and Feldman, 1999; Wood and Kardash, 2002); the critical and creative thinking process (Ennis, 1985; Sternberg and Lubart, 1999; Csikszentmihalyi, 1996); introducing the intellectual standards of critical and creative thinking (Paul and Elder, 2012); peer evaluation (Nystrand,1989; Volz, 2009); assessing creative thinking in the classroom (AAC&U Value Rubrics; Stein et al, 2006); divergent and convergent thinking (Schommer, 1990); critical thinking scenarios (Carson, 2015a); data visualization and concept mapping (Novak, 1990); writing to think (Anson and Beach, 1995; Angelo and Cross, 1993); and metacognition and self-reflection (Paulesen and Feldman, 1999; Bruning et al, 1995; Hofer and Pintrich, 1997; Schommer, 1990).

2.3. Faculty Participation

Over 130 faculty, representing all undergraduate-serving colleges at NC State, have participated as TH!NK Faculty over the past five years. Faculty survey responses indicated that >95% of TH!NK Faculty made enhancements not only to their TH!NK course, but to other courses they teach. In addition, many TH!NK Faculty and Fellows have published or presented scholarship related to their TH!NK work. References to these papers (8) and proceedings (18) are available at https://think.dasa.ncsu.edu/.

It is important to emphasize that while the TH!NK Faculty were "trainees," they made tremendous contributions to every aspect of the faculty development over the past 5 years. Many contributed constructive feedback on our training and resources, provided examples of exceptional and innovative discipline-specific classroom activities and assignments, and all provided peer support and feedback to other participants.

3. TH!NK Faculty Scholarship Development

We have formalized a research track for TH!NK Faculty alumni (TH!NK Researchers Program) to provide training on how to collect data and publish research projects based on

their redesigned courses. These studies measure changes in student learning as a result of the innovations introduced by the TH!NK program. A series of workshops for the TH!NK Faculty gives a framework for beginning their SoTL research. These workshops provide the structure for continued participation in the cohort, individual mentorship, and financial support to attend disciplinary conferences. Each participant receives $2000 to travel to present work at a conference or to use toward professional development activities.

This structural and financial support helps new and emerging SoTL researchers and faculty with prior publishing experience to form a learning community. In many departments, faculty with a primary teaching role lack a mechanism for engaging in SoTL research and publishing, yet it is becoming increasingly more important in the tenure, promotion, and review process. Training included support in the research process, and covered the following areas: introduction to the scholarship of teaching and learning; steps of the research process/ basic study design; generating research ideas: new idea vs. using existing data; outlets for presentation/publication; qualitative methods; the institutional review board (irb) process; educational data collection and analysis; writing support; presentation and dissemination of results; challenges when doing educational research; and grant applications for further funding.

Preliminary outcomes of the first cohort indicate that the faculty involved have been actively submitting conference abstracts and preparing journal articles. Program participants have reported increased confidence in their ability to share their educational findings as a result of their participation in the TH!NK Researchers Program.

4. Sustaining the Program

To sustain the impact of TH!NK across campus, a culture of self-sufficiency was a primary focus for the second phase of the TH!NK program. In addition to the TH!NK Researchers Program mentioned above, we have developed multiple stand-alone resources for faculty.

In Spring 2018, TH!NK Fellows compiled teaching and SoTL research resources on the TH!NK website. These resources serve two main functions: 1) to reinforce faculty training for TH!NK alumni and 2) to provide additional faculty TH!NK program resources. All handouts, slide presentations, and assessment tools presented in the May and August teacher training as well as the SoTL researcher training are accessible. Additionally, the website contains evidence-based Teaching Strategy Resources Sheets which provide overviews of a variety of teaching strategies, offer 3-4 examples of college level exercises which use the strategy in different disciplinary or class-type settings, and provide sources for further information. Each of these Teaching Strategy Resource Sheets describes how the featured strategy fits within the critical and creative process. Another key component to the online resources is an Assignment Database which is populated with original classroom assignments

and activities created by NC State THINK Faculty. Each entry is tagged by discipline, the scale of the activity or assignment, and most importantly, the skills in the critical and creative thinking process that students must employ. The database is accessible at https://apps.dasa.ncsu.edu/think/public/index.php.

5. Preliminary Outcomes and Assessment

We are in the process of gathering summative data on the student learning outcomes of the first five years of the initiative. Preliminary assessment is discussed below.

Over 11,000 students (enrollments) have been impacted directly in TH!NK sections to date. However, we know that the number of students impacted is much greater, with 95% of TH!NK Faculty reporting enhancements to their other sections and classes.

We use three measures of assessment for student learning outcomes: the Critical-thinking Assessment Test (CAT) developed by Tennessee Tech; the TH!NK Common Rubric that is based on AAC&U VALUE rubric and current research on creativity; and student surveys. A bird's eye view of the data points to gains in a greater number of different critical thinking skills as assessed on the CAT in 2015 and 2016 compared to the 2013 pre-TH!NK baseline year. Prior to implementation, planners of the QEP targeted the "emerging" level on the Common Rubric as the level we would hope to bring our students to over the course of their first semester. On average, we hit that benchmark for most rubric dimensions. The dimensions of "intellectual risk taking" and "recognizing assumptions" appear to be the areas where our students struggle the most. Regardless, our students have plenty of room to grow in the skills identified in the Common Rubric, and that is one reason why we decided to expand TH!NK into upper-level courses.

We use multiple measures of student growth and ability because each instrument has strengths and limitations. The CAT measures a number of transferable critical thinking skills in a discipline non-specific manner. This allows us to use this as a common instrument across classes/majors, and because the scoring is standardized, it reduces scorer subjectivity. The limitations of the CAT include the exclusion of many of the creative thinking skills we want to impact; our incoming freshmen score very high on this test, and therefore we see a ceiling effect in some items for a large portion of our students; and we do face concerns over effort during test taking for more advanced students compared to incoming freshmen since there is not a grade motivator.

The TH!NK Common Rubric assesses the critical and creative thinking skills that NC State University's QEP identified as outcomes it wanted our students to achieve since it was tailored specifically to our program. Unlike the CAT, this rubric is applied to work that students did as a part of their course, and so most are motivated to try their best because the

assignment contributes to their class grade. Limitations of this rubric is that every assignment is different. Some assignments may have more room for critical and creative thinking than others, and although we hold required rubric norming sessions, scoring does have some subjectivity.

6. Conclusion

In continuing to grow and expand the TH!NK program, we continue to look for new opportunities to encourage a culture of critical and creative thinking that includes more and more informal learning opportunities. Now in its 5th year, the TH!NK program has been successful in creating a culture where faculty engage more intentionally in integrative learning in order to help students go deeper into their inquiry and reflection. But there is still room to grow in providing consistent opportunities in a coordinated manner across all curricula, to guide students in threading their varied experiences together in a significant way, and to initiate opportunities—inside and outside of the classroom—to seek out deeper knowledge around areas of interest that support student inquiry in new and innovative ways. There are also opportunities to leverage resources that are currently available (e.g. General Education requirements) to make those courses and experiences aligned with the higher order thinking skills that are at the core of the program.

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Cat Test: https://www.tntech.edu/cat/

AAC&U Value Rubrics: https://www.aacu.org/value-rubrics

TH!NK Common Rubric: https://think.dasa.ncsu.edu/wp-content/uploads/sites/ 20/2018/05/11-Common-Rubric-2018.docx.pdf

THINK student survey: https://think.dasa.ncsu.edu/reflection-survey/.

Enhancing understanding of analytic geometry by augmented reality

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Abstract

An augmented reality (AR) system is a technology which combines computer-generated representations or information and reality in real-time. Instead of substituting the real situation, as it is possible with dynamic geometry systems (DGS), AR adds virtual objects or information to reality to make the situation experiential. The project MalAR aims at investigating the impact of an augmented reality (AR) learning environment in the subject area of analytic geometry. The focus of the AR learning environment is an AR-App, which supports learners understanding of mathematics situations usually given through textbook tasks. Mathematics situations are implemented in an AR-App such that the situation gets visually and enactively explorable by changing perspectives using the own body movement. The added value of integrating AR in mathematics classes is worked out and based on different learning theories like embodied cognition. The AR-App and the project will be presented. With the findings and results of the study evidence-based didactical insights in the teaching and learning with AR in mathematics instruction may be identified and needs for future AR-supported learning scenarios can be revealed.

Keywords: augmented reality; digital tools; mathematics education.

1. Introduction

Increasing digitization not only modifies professional and private demands but also creates possibilities with high potential for teaching and learning. In order to integrate promising developments in schools, there is a need for teaching and learning concepts and teacher qualification. Making innovations available for teaching and learning, beyond the provision of hardware and software, is central.

In the field of digital media, the augmented reality technology (AR) gets great attention for a couple of years, although Sutherland already developed the first user interface in the early 60's. Technological development of smartphones and their cameras made it interesting for educational research more recently. Not least the 2017's release of Apples AR Kit opened the market for public app-development in that field.

AR technology allows for completing the real word (e.g. the view through the smartphone camera) by virtual objects, material or information. The coexistence of virtual objects and real environment makes it possible to picture complex spatial relations in a so far unprecedented way (Avanitis, Petrou, Knight, Savas, & Gargalakos, 2007). The experience of complex phenomena and the interaction with two- and three-dimensional objects by AR has never been more tangible (Kerawalla, Luckin, Seljeflot, & Woolard, 2006; Klopfer & Squire, 2008). Those advantages brought researcher to call AR an interdisciplinary key technology for the next years (Johnson, Levine, Smith, & Haywood, 2010a, 2010b; Martin, et al., 2011).

However, the AR research in the field of education is still at an early stage (Wu, Lee, Chang, & Jyh-Chong, 2013, p. 47). Especially in mathematics education there is a lack of studies investigating the use, advantages and key success factors of AR in teaching and learning. Kaufmann and Schmalstieg for example investigated the effects of AR on the concept of space (Kaufmann & Schmalstieg 2003; Kaufmann, Steinbügl, Dünser, & Glück, 2005). To exploit the full potential of AR, its additional value should be in focus. Based on this, the need for concrete learning environments can be worked out to provide an enriching access to AR for teachers and to support learners throughout the AR learning environment.

2. Augmented reality (AR)

An augmented reality (AR) system is a technology which combines computer-generated representations and reality in real-time (Milgram & Kishino, 1994). Instead of substituting the real situation, as it is possible with dynamic geometry systems (DGS), AR adds objects or information to make it experiential (Azuma, 1997; Martin-Gutierrez, Saorin, Contero, Alcaniz, & Perez-Lopez, 2010).

Figure 1 shows the visualisation of a textbook task using the so far unpublished AR-App "GeometAR". A cube, a plane and a straight line, positioned within a fixed coordinate system, is added to the real world-view through the iPad-camera. The user can experience the augmented situation instead of only reading a textbook task by moving around to explore the mathematical object from every angle and level of detail.

Figure 1. AR-App "GeometAR" (source D. Birnbaum): View thorugh the iPad-camera showing the reality (desk) augmented with a cube posititioned within a fixed coordinate system, a plane and straight line.

In literature there is no consistent definition of AR. The definitions range from a narrower characterisation highlighting technological aspects, to broader views on AR. In accordance with Wu et al. (2013, p. 42) a broader definition which include the application of different devices (desktop PCs, tablets, smartphones, data goggles, …) seems to better portray the necessities in the field of education. AR can be understood as situation in which real world content is dynamically overlaid with related location- or content-specific information (Klopfer & Squire, 2008, p. 205). This perception emphasizes that AR is technology-based but also needs to be conceptualised to enrich the situation. Thus, AR should be understood as a concept rather than a technology to bring its education-theoretical aspects to the fore (Zhou, Duh, & Billinghurst, 2008).

3. Added value of AR

The benefits of AR for the teaching and learning in the field of mathematics instruction are based on

- organisational aspects, which are especially important for teachers,

- • physical aspects based on the theory of embodiment and the cognitive load theory
- • and cognitive aspects, which characterize the symbolic relation between physical objects and abstract mathematical concepts.

3.1. Organisational aspects

Organizational aspects often complicate the integration of digital media in class. Problems range from changing class room to PC room, time-consuming login procedures and long learning phases for special PC programs, to name but a few. The recently developed smartphone compatibility of AR gives teachers more organisational scope and gives learners the possibility to learn in a familiar setting. The operation through body movement as intuitive pattern of action is a decisive advantage of AR. The implementation of virtual objects in the immediate real environment of the learners facilitates the understanding of the situation.

3.2. Physical aspects

The theory of embodied cognition describes the mutual influence between physical interaction and human thinking (Tran, Smith, & Buschkuehl, 2017). It is closely related to the cognitive load theory (cf. Sweller, 1988) which assumes that learning results in cognitive load and describes how learning can be facilitated or complicated. Physical body movements, as they are necessary to change the perspective using AR, can support the understanding of spatial coherences (Bujak, et al., 2013, p. 538). Instead of imagining the mathematical situation, learners can enactively explore it such that there are larger cognitive capacities to understand mathematical correlations and solve the task.

3.3. Cognitive aspects

Mathematical concepts and its physical representations are linked by symbolic language. The possibility of spatiotemporal contiguity of physical and symbolic representation through AR can help learners to see correlations and to better understand underlying mathematical concepts (Bujak, et al., 2013, p. 540). Especially in upper secondary the mathematical concepts get more abstract and, thus, more demanding. The direct spatiotemporal representation of symbolic language (e.g. symbolic representation of lines and planes) together with their enactive-iconic (via AR) representation, can facilitate the coherence for learners by combining originally disjoint representations.

4. AR in analytic geometry: the project MalAR

Besides the use of AR as additional source of information, its application in mathematics in the subject area of geometry is obvious. While physical representations can be used in lower secondary education, it becomes difficult beyond, particularly in analytic and differential

geometry because of the increasing complexity of mathematics representations. Those topics require a high level of spatial ability which can be visually supported by e.g. dynamic geometry software or AR. AR offers additional promising opportunities mentioned in section 3, whose effects should be subject of research.

The aim of MalAR (Eng. transl.: learning mathematics with AR – an empirical study about the learning effectiveness of AR in analytic geometry) is the development and testing of an AR learning environment, which supports learning of analytic geometry by enactively operating within the learning environment. An AR-App provides mathematics tasks which correspond to the mathematics class. This AR-representation enables learners to explore the mathematics situation independently by moving within the situation. According to the intended added value of AR described in section 3, questions about the learning effectiveness and impact on spatial ability can be deduced. MalAR aims at placing the AR learning environment on a learning theory footing to provide substantiated and effective applications. MalAR pursues the following key questions:

1. What kind of effect does the AR-learning environment have in terms of learning effectiveness compared to conventional instruction?
2. What kind of effect does the AR-learning environment have in terms of spatial ability compared to conventional instruction?

Key question 1 will be investigated by a quasi-experimental intervention study in the subject area "planes". The performance of experimental groups will be compared to control groups who do not use the AR learning environment in mathematics class. Key question 2 addresses the spatial ability which is especially important in analytic geometry. By investigating correlations of key question 1 and 2, relevant factors of the AR learning environment on learning may be evaluated in more detail.

4.1. The AR learning environment

The AR learning environment is developed for the subject area "planes" within the wider topic analytic geometry for upper secondary mathematics classes. Especially distance calculation and position considerations are of interest. In conventional mathematics class a visualisation of the mathematical situation is limited to oblique projection.

During the topic "planes" the learners of the experimental groups elaborate on tasks which are additionally implemented in the AR-app. Through the AR-representation of the mathematics situation learners can view and explore the situation by moving their body around it. Furthermore, learners can type in their solution and visually investigate its correctness. In contrast to conventional mathematics class the AR learning environment allows for an enactive involvement in the mathematics situation. The following example demonstrates the AR-app.

A plane $E_1: 2x - y - z = -1$ is given. We are looking for a plane E_2, which contains point $A(3|1|2)$ and is orthogonal to plane E_1. Determine E_2 and the intersecting line g of the two planes.

The AR-App visualizes the given information "walk-on-able" within the smartphone's camera image by virtually adding a three-dimensional fixed coordinate system. An input area is provided to type in E_1 and A (Figure 3 left). After having calculated the solution by hand, the learner can type in his solution (Figure 2, Figure 3 right) and visually check its correctness by exploring the situation from different views changing the camera perspective through body movement.
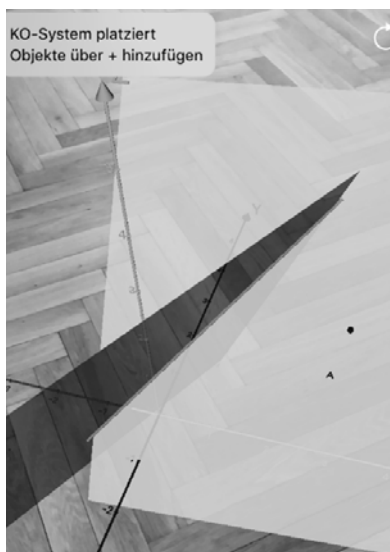

Figure 2. Screenshot of the AR-App representation of the solution. E_1(dark grey), E_2(pale), intersecting line g and point A.

Figure 3. Visualisation of coordinate system, plane E_1 and A (left). The solution, plane and intersecting line g (right)

4.2. Method

During a pilot phase the further development and testing of the AR-app and AR learning environment is of primary importance. The AR-app is based on the unpublished iOS-app "GeometAR" (Birnbaum & Ludwig, 2017) in cooperation with the working group MATIS 1from the Goethe-University Frankfurt.

During a quasi-experimental study with experimental and control groups key questions 1 and 2 are particularly in focus. The mathematics class of the experimental groups is supported by the AR learning environment. Prior to the treatment both groups sit a mathematics test to factor in mathematics achievement when considering key question 1.

Following the treatment, all learners sit a post-test consisting of former Abitur assignments. With the results of the post-test it can be investigates if the AR learning environment has effects on the learning in the subject area "planes". With reference to key question 2 the learners also sit a test concerning spatial ability to determine effects of the treatment on this specific content.

5. Outlook

The integration of digital everyday technology, like smartphones, has still not found its way into many schools in Germany. Not least missing teaching concepts contribute to this situation. In the area of AR, as the newest development in this area, most of the studies consider implementation opportunities without investigating the learning theory background. Besides the many known chances of AR in general it is worth looking at the teaching situation. The perspective can be shifted by the AR learning environment from a teacher-

centred to a more learner-centred one where the learner's mathematical actual involvement can be increased (cf. Schratz, 2009). With the findings and results of the study evidence-based didactical insights in the teaching and learning with AR in mathematics instruction can be identified and needs for future AR-supported learning scenarios will can be revealed.

A next step is the extension of the AR learning environment to further subject areas. Furthermore, the AR-App will be equipped with a self-implemented module where teachers can implement tasks by themselves which they then want to use in their class.

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